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1881

DEFENDANT'S EXHIBIT.

Certified Copy of File-wrapper and Contents of Schwarz Patent No. 807,501.

United States of America,

Department of the Interior,

United States Patent Office.

To all to whom these presents shall come, Greeting:

This is to certify that the annexed is a true copy from the Records of this Office of the File Wrapper and Contents, in the matter of the Letters Patent of Alfred Schwarz, Assignor to Schwarz Ore Treating Company, Number 807,501, Granted December 19, 1905, for Improvement in Processes of Concentrating Ores.

In testimony whereof I have hereunto set my hand and caused the seal of the Patent Office to be affi ed at the City of Washington, this 20th day of May, in the year of our Lord one thousand nine hundred and twelve and of the Independence of the United States of America the one hundred and thirty-sixth.

[SEAL.]

F. A. TENNANT,
Acting Commissioner of Patents.

1882

2–437.

Divn. XXV.

Number (Series of 1900).
256,487.

1905.

Div. 3 25.
(Exr.'s Book) 62½.

Patent No. 807,501.

Name: Alfred Schwarz, Assor. to Schwarz Ore Treating Company, 5.
of I hœnix, Territory of Arizona, a corporation of Territory of Arizona.

Of New York,
State of New York.

Invention: Process of Concentrating Ores.

		Original.	Renewed.
Parts of application filed.	Petition,	Apl. 19, 1905,	—— —, 190-.
	Affidavit,	" " 1905,	—— —, 190-.
	Specification,	" " 1905,	—— —, 190-.
	Drawing,	—— —, 190-,	—— —, 190-.
	Model or Specimen Not reqd.,	—— —, 190–,	—— —, 190-.
	1 First Fee, Cash $15	Apr. 9, 1905,	—— —, 190-.
	" " Cert.,	—— —, 190–,	—— —, 190-.
	Appl. filed complete	Apl. 19, 1905,	—— —, 190-.
Examined, Lewis B. Wynne,		July 12th, 1905,	—— —, 190-.
Countersigned, J. W. Babson,		—— —, 190-.	
		For Commissioner.	For Commissioner.
Notice of Allowance,		July 13, 1905,	—— —, 190-.
Final Fee, Cash $20,		Nov. 25, 1905,	—— —, 190-.
2. " " Cert.,		—— —, 190-,	—— —, 190-.

[On left margin:] Division of App. No. —, filed —— —, 190-.

1883 Patented December 19, 1905.
Associate Attorney —— ——.
Attorney Chas. S. Jones, 141 B'dway, New York, N. Y.
Name —— ——.
3. Patent No. ——.
Serial Number ——.
Date of Patent ——.

$15, Ck., Received Apr. 19, 1905. Y. Chief Clerk, U. S. Patent Office.

New York, April 15, 1905.

Hon. Commissioner of Patents, Washington, D. C.

SIR: I enclose herewith the papers in the matter of the application of Alfred Schwarz for an improvement in the Process of Concentrating Ores together with check for $15.00 in payment of the filing fee thereon.

Respectfully,

CHARLES S. JONES.

(Enclo.)

1884 Mail Room,
Apr. 19, 1905,
U. S. Patent Office.

Application.

Serial No. 256,487, Paper No. ½.

Petition.

To the Commissioner of Patents:

Your petitioner, Alfred Schwarz, a subject of the Emperor of Germany and a resident of the Borough of Manhattan, City, County and State of New York, and whose Post Office address is No. 505 Broome Street, in the said City and State of New York, prays that Letters Patent may be granted to him for the new and useful improvements in the Process of Concentrating Ores set forth in the annexed specification; and he hereby appoints Charles S. Jones of 141 Broadway in the said City, County and State of New York, his attorney with full power of substitution and revocation, to prosecute this application, to make alterations and amendments therein, to sign the drawings, to receive the patent and to transact all business in the Patent Office connected therewith.

Signed at New York City, this 31st day of January, 1905.

ALFRED SCHWARZ.

To all whom it may concern, be it known that I, Alfred Schwarz,
a subject of the Emperor of Germany and a resident of the
1885 Borough of Manhattan, City, County and State of New York,
have invented certain new and useful improvements in the Process of Concentrating Ores of which the following is a specification.

In the concentration of ores by the employment of hydrocarbons as adhesive agents, it has been observed that sulfids yield better results than oxids, carbonates and chlorids. In fact, so far as known to me, a practical application of such process before my inventions relating to this art, has been largely, if not wholly, confined to sulfid ores. The object of the present invention is to extend the application of hydrocarbon concentrating processes to ores heretofore considered unworkable, by first converting such ores into sulfids preferably by a wet method to thereby preserve the mass of ore in its crushed condition and suitable for treatment according to known methods.

In carrying out the present invention I proceed by preparing a soluble sulfid in any well known manner, for example by dissolving sulfur in an aqueous solution of potassium or sodium hydrate, the sulfur being added in sufficient quantity to give the desired reaction. The pulverized ore containing the mineral in the form of oxid, carbonate or chlorid is then mixed in a suitable vessel with the sulfid

solution, the mass being either cold or heated by suitable means and the vessel provided with an agitator to effect a thorough and intimate mixture. During this operation the oxid, carbonate or chlorid is converted into a sulfid by the action of the potassium or
1886 sodium sulfid, a form which is capable of subsequent practical treatment with hydrocarbons for the separation of the values from the earthy or rocky constituents of the ore. As the action of the hydrocarbon on the metallic constituents of the ore is a surface action, it is unnecessary to proceed so far as to convert the entire mass of the particles of oxid, carbonate or chlorid into a sulfid, it being sufficient if the surface of the particles is so converted as thereby there is presented all that is necessary for the desired action of the hydrocarbon.

After the initial conversion as above described the ore may be concentrated by any suitable treatment with a hydrocarbon, and for such purpose I may use a hydrocarbon which is normally liquid, or one which is solid at normal temperatures, or the latter in admixture with the former as described in my application- serial Nos 210,137, 210,138, 225,370 and 231,395 and U. S. Patent No. 771,277. Of hydrocarbons which are solid at normal temperatures and required to be melted there may be used paraffin or ozocerite, or a resinous hydrocarbon such as resin, pitch or asphaltum. Of normal liquid hydrocarbons there may be used any suitable vegetable, animal or mineral oil. These hydrocarbons may be used singly or in combination of two or more, it being understood that the constitution of the adhesive agent will depend upon the character of the ore to be treated, varying as the ore varies.

Ore, either in a dry or wet condition, is mixed in any suitable vessel having an agitator with the hydrocarbon, sufficient quantity
1887 being added to effect the desired separation. If the hydrocarbon is one which is solid at normal temperatures, it is first melted and then stirred in with the ore, the mixture being effected by any suitable mechanical means and if desired air, steam or gas may be injected into the mass either alone or to assist the mechanical agitation. The injection of such gaseous agent results in the hydrocarbon taking up an appreciable quantity of air or gas giving a certain sponginess which increases its floating power.

As a specific example of my invention I have used as an adhesive agent a mixture of paraffin and resin, heat being employed if necessary to maintain this compound in a melted condition after it has been mixed with the ore.

After an intimate mixture with all parts of the ore has been effected the mass is subjected to the action of water heated to any desired temperature even as high as the boiling point whereby the earthy or rocky constituents are liberated and washed out and settled in the bottom of the vessel. The metallic constituents of the ore having united with the adhesive agent may be skimmed or screened off and run to a centrifugal drier for the separation or recovery of the concentrates from the adhesive agent.

Instead of subjecting the mass to the action of heated or boiling water, cold water, preferably under pressure, may be injected into

the mass, the effect of which is to solidify or granulate the adhesive agent, which, with the entrapped metallic constituents, may
1888 be floated or screened off, while the tailings being saturated with water will be precipitated more or less completely to the bottom of the vessel. By subjecting the mass to heat in a suitable vessel the adhesive agent is melted and the concentrates may be separated and recovered therefrom by a centrifugal driver, filter press or other means. The mass of ore adhesive agent may first be treated with heated or boiling water and subsequently treated with cold water. Also during the treatment with water which may be made acid or alkaline if desired, the mass may be agitated mechanically or by the injection of air, steam or gas.

The concentrates if necessary may be washed with a solution of potassium or sodium hydrate to remove any remaining portions of the adhesive agent.

While I have described in giving a specific method of procedure the use of a mixture of paraffin and resin, I may use either one of these singly, the successive steps of the operation being the same. Or I may use singly or normally liquid hydrocarbon following the same method of operation except in such case there will of course be no solidification or granulation of the hydrocarbon. When using a normally liquid hydrocarbon the mass may be treated either with cold or heated water to effect the separation of the adhesive agent with the metallic constituents of the ore from the tailings.

The essential feature of the present invention is the conversion of an ore of the character above specified into a sulfid to adopt it
1889 for treatment by a hydrocarbon. The particular method of concentrating by the employment of a hydrocarbon being varied according to known methods as may be desired or suitable to the particular ore, and while I have given specific examples, I do not wish to be wholly restricted thereto.

In carrying out the conversion above described, I use an excess of sulfur above the theoretical quantity necessary to effect the change of oxid, carbonate or chlorid to sulfid.

What I claim and desire to secure by Letters Patent is:

1. The method of treating ores which consists in subjecting a non-sulfid ore to the action of a soluble sulfid to convert the mineral into a sulfid, then treating the mass with a hydrocarbon and finally separating the hydrocarbon with the entrapped metallic constituents of the ore from the tailings.

June 30/05. 2. The method of treating an ore containing [the mineral in the form of an oxid, carbonate or chlorid]* by subjecting the same to the action of

non-sulfid mineral

an alkaline sulfid to convert the mineral into a sulfid, then treating the mass with a hydrocarbon and finally separating the hydrocarbon with the entrapped metallic constituents of the ore from the tailings.

[*Words and figures enclosed in brackets erased in copy.]

June 30/05. 3. The method of treating an ore containing non-sulfid mineral [the mineral in the form of an oxid, carbonate or chlorid]* by subjecting the same to the action of an aqueous solution of potassium or sodium sulfid to convert the mineral into a sulfid, then treating the mass with hydrocarbon and finally separating said hydrocarbon with the entrapped metallic constituents of the ore from the tailings.

June 30/05. 4. The method of treating an ore containing non-sulfid mineral [the mineral in the form of an oxid, carbonate or chlorid]* by subjecting the same to the action of a soluble sulfid then treating the resulting metallic sulfid with a melted hydrocarbon which is solid at normal temperatures and finally separating said hydrocarbon with the entrapped metallic constituents from the tailings.

June 30/05. 5. The method of treating an ore containing non-sulfid mineral [the mineral in the form of an oxid, carbonate or chlorid]* by subjecting the same to the action of a soluble sulfid then treating the resulting metallic sulfid with a compound of melted paraffin and resin, then separating said compound with entrapped metallic constituents from the tailings.

In testimony whereof I have hereunto signed my name in the presence of two subscribing witnesses:

ALFRED SCHWARZ.

Witnesses:

E. F. PORTER.

ALEXANDER RODMAN.

STATE OF NEW YORK,
County of New York, ss:

[On left margin:] See Oath filed June 30/05.

Alfred Schwarz, the above-named petitioner, being duly sworn deposes and says that he is a subject of the Emperor of Germany and a resident of the Borough of Manhattan, City, County and State of New York; that he verily believes himself to be the original, first and sole inventor of the improvements in the Process of Concentrating Ores described and claimed in the annexed specification; that he does not know and does not believe that the same was ever known or used before his invention or discovery

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[*Words and figures enclosed in brackets erased in copy.]

thereof, or patented or described in any printed publication in any country before his invention or discovery thereof, or more than two years prior to this application, or in public use or on sale in the United States for more than two years prior to this application; that said invention has not been patented to him or to others with his knowledge or consent in this or any foreign country for more than two years prior to this application; or on an application for a patent filed in any country foreign to the United States by him or his legal representatives or assigns more than twelve months prior to this publication, and that no application for a patent on said improvements has been filed by him or his legal representatives or assigns in any country foreign to the United States.

ALFRED SCHWARZ.

Sworn to and subscribed before me this 31st day of January, 1905.

[SEAL.] E. F. PORTER,
Notary Public, No. 58, Kings Co.

Certificate filed in N. Y. Co.

1892 2–260.

Div. 25, Room 315.

Paper No. 1.

Address only "The Commissioner of Patents, Washington, D. C."

All communications respecting this application should give the serial number, date of filing, and title of invention.

Department of the Interior,

United States Patent Office,

Washington, D. C., June 20, 1905.
Mailed " " "

Alfred Schwarz, care Chas. S. Jones, New York City:

Please find below a communication from the Examiner in charge of your application, #256,487, filed April 19, 1905, for Process of Concentrating Ores.

F. J. ALLEN,
Commissioner of Patents.

The 2nd, 3rd, 4th and 5th claims are alternative in form in reciting "an oxid, carbonate or chlorid." It is suggested that a single non-alternative generic expression be employed in lieu of the alternative one quoted; thus the material might be defined as "ore containing non-sulfid mineral." With the change suggested, the claims would probably be allowable.

1893 In view of the delay between the execution of the oath and the filing of the application, a new oath is required ex parte Branna, 97 O. G., 2533.

LEWIS B. WYNNE,
Examiner, Division XXV.

T. F. MITCHELL.

Mail Room,
Jun- 30, 1905,
U. S. Patent Office.

Patent Office,
Jun- 30, 1905,
Division XXV.

Room 315.

Serial No. 256,487, Paper No. 2.

Application of Alfred Schwarz. Serial No. 256,487. Filed April 19, 1905. Process of Concentrating Ores.

Hon. Commissioner of Patents, Washington, D. C.

SIR: Replying to the Examiner's letter of June 20th, 1905, please amend the above entitled application as follows:—

Claim 2, line 2, cancel "the mineral in the form of an oxid, carbonate or chlorid" and substitute therefor "non-sulfid mineral."

Claim 3, lines 1 & 2 2, cancel "the mineral in the form of an oxid, carbonate or chlorid" and substitute therefore "non-sulfid mineral."

1894 Claim 4, line 2, cancel "the mineral in the form of an oxid, carbonate or chlorid" and substitute therefor "non-sulfid mineral."

Claim 5, line 2, cancel "the mineral in the form of an oxid, carbonate or chloride" and substitute therefor "non-sulfid mineral."

The claims have been amended in accordance with the Examiner's suggestion.

A new oath is enclosed herewith.

An early allowance of the case is requested.

Respectfully submitted,

CHARLES S. JONES,
Attorney for Applicant.

Dated New York City, N. Y., June 22, 1905.

In the Matter of the Application of Alfred Schwarz. Serial No. 256,487. Filed April 19, 1905. Process of Concentrating Ores.

STATE OF NEW YORK,
County of New York, ss:

Alfred Schwarz, the petitioner named in the above entitled application, being duly sworn deposes and says that he is a subject of the Emperor of Germany and a resident of the Borough of Man-

hattan, City, County and State of New York; that he verily believes himself to be the original, first and sole inventor of the improvements in the Process of Concentrating Ores described and claimed in the specification annexed to said petition; that he does not know and does not believe that the same was ever known or used
1895 before his invention or discovery thereof, or patented or described in any printed publication in any country before his invention or discovery thereof, or more than two years prior to the filing of said application, or in public use or on sale in the United States for more than two years prior to the filing of said application; that said invention has not been patented to him or to others with his knowledge or consent in this or any foreign country for more than two years prior to the filing of said application, or on an application for a patent filed in any country foreign to the United States by him or his legal representatives or assigns more than twelve months prior to the filing of said application and that no application for a patent on said improvement has been filed by him or his legal representatives or assigns in any country foreign to the United States.

ALFRED SCHWARZ.

Subscribed and sworn to before me this 28th day of June 1905.

[SEAL.] OLIN A. FOSTER,
Notary Public, Queens County.

Certificate filed in New York County.

1896 2-181.

Serial No. 256,487.

A. S. W.

Issue Division.

All communications should be addressed to "The Commissioner of Patents, Washington, D. C."

Department of the Interior,

United States Patent Office,

Washington, D. C., July 13, 1905.

Alfred Schwarz, Assor., c/o Chas. S. Jones, 141 Broadway, New York, N. Y.

SIR: Your application for a patent for an Improvement in Process of Concentrating Ores filed Apl. 19, 1905, has been examined and allowed.

The final fee, twenty dollars, must be paid, and the Letters Patent bear date as of a day not later than six months from the time of this present notice of allowance.

If the final fee is not paid within that period the patent will be withheld, and your only relief will be by a renewal of the application, with additional fees, under the provisions of Section 4897, Revised Statutes. The office aims to deliver patents upon the day of their date, and on which their term begins to run; but to do this properly applicants will be expected to pay their final fees at least
1897 twenty days prior to the conclusion of the six months allowed them by law. The printing, photolithographing, and engrossing of the several patent parts, preparatory to final signing and sealing, will consume the intervening time, and such work will not be done until after payment of the necessary fees.

When you send the final fee you will also send, distinctly and plainly written, the name of the inventor and title of invention as above given, date of allowance (which is the date of this circular), date of filing, and, if assigned, the names of the assignees.

If you desire to have the patent issue to assignees, an assignment containing a request to that effect, together with the fee for recording the same, must be filed in this office on or before the date of payment of final fee.

After issue of the patent uncertified copies of the drawings and specifications may be purchased at the price of five cents each. The money should accompany the order. Postage stamps will not be received.

Respectfully,

F. J. ALLEN,
Commissioner of Patents.

After allowance, and prior to payment of the final fee, applicants should carefully scrutinize the description to see that their statements and language are correct, as mistakes not incurred through the fault of the office, and not affording legal grounds for reissues, will not be corrected after the delivery of the letters patent to the patentee or his agent.

1898 In remitting the final fee give the serial number at the head of this notice.

If payment is made by check or draft, the credit allowed is subject to the collection of the same.

2–103.

$20 received as the final fee in the application of A. Schwarz 256,487 for Process of Concentrating Ores applies from a composite letter No. 219,761 received Nov. 25, 1905, from Jones C. S. which is on file in the Chief Clerk's room. B./M. R.

J. W. BABSON,
Chief of Issue and Gazette Division.

J. J. D.

1899

2–191.

Serial No. 256,487.

S. M.

Issue Division.

Address only "The Commissioner of Patents, Washington, D. C."

Department of the Interior,

United States Patent Office,

Washington, D. C., Nov. 25, 1905.

Alfred Schwarz, Assor., c/o Chas. S. Jones, 141 Broadway, New York, N. Y.

SIR: You are informed that the final fee of twenty dollars has been received in your application for Improvement in Process of Concentrating Ores.

Very respectfully,

F. I. ALLEN,
Commissioner of Patents.

[Here follows printed copy of Patent 807,501.]

1900 1905.

83. Mills.
Ore and Coal Washers.

Contents.

Print, —— —, ——.
Application, — papers.
1. Letter, June 20, 1905.
2. Amendment, June 30, 1905.
4.
5.
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22.
23.

Title: Improvement in Process of Concentrating Ores.

1901 DEFENDANT'S EXHIBIT.

Certified Copy of File-wrapper and Contents of Schwarz Patent No. 807,503.

United States of America,

Department of the Interior,

United States Patent Office.

To all to whom these presents shall come, Greeting:

This is to certify that the annexed is a true copy from the Records of this Office of the File Wrapper and Contents, in the matter of the Letters Patent of Alfred Schwarz, Assignor to The Schwarz Ore Treating Company, Number 807,503, Granted December 19, 1905, for Improvement in Processes of Concentrating Ores.

In testimony whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed at the City of Washington, this 20th day of May, in the year of our Lord one thousand nine hundred and twelve and of the Independence of the United States of America the one hundred and thirty-sixth.

[SEAL.]

F. A. TENNANT,
Acting Commissioner of Patents.

1902 2–437.

Number (Series of 1900)
210,138.

1904.

Divn. XXV.
Div. 25.
(Exr.'s Book.) 86-145.

Patent No. 807,503.

Name: Alfred Schwarz, Assor. to The Schwarz Ore Treating Company, of Phœnix, Ter. of Arizona, a corp. of Ter. of Arizona.
Of New York (Manhattan).
County of ——.
State of New York.
Invention Process of Concentrating Ores.

Parts of application filed.		Original.	Renewed.
	Petition,	May 27, 1904,	—— —, 190-.
	Affidavit,	" " 1904,	—— —, 190-.
	Specification,	" " 1904,	—— —, 190-.
	Drawing,	May 10, 1905,	—— —, 190-.
	Model or Specimen, not reqd.,	—— —, 190–,	—— —, 190-.
	First Fee, Cash $15,	May 27, 1904,	—— —, 190-.
	1. " " Cert.,	—— —, 190-,	—— —, 190-.
	Appl. filed complete	May 27, 1904,	—— —, 190-.

Examined, Lewis B. Wynne, Ex.,
June 29th, 1905, —— —, 190-.
Countersigned, J. W. Babson, —— —, 190-.
For Commissioner. For Commissioner.
Notice of allowance, July 6, 1905, —— —, 190-.
Final Fee, Cash $20, Nov. 25, 1905, —— —, 190-.
2. " " Cert., —— —, 190–, —— —, 1905.
Patented December 19, 1905.

[On left margin:] Division of App. No. —, filed —— —, 190-.

1903 Associate Attorney, —— —— Attorney, Chas. S. Jones,
141 Broadway, New York, N. Y.
Name, —— ——. Serial Number, ——.
3. Pat. No. —. Date of Patent, ——.

2–057.

$15.00 received as the application fee in the application of A. Schwarz for Process of Concentrating Ores applied from a composite letter No. 101,469 received May 27/04 from Chas. S. Jones which is on file in the Chief Clerk's room. App/D.

S. M. POL,
Application Clerk.

S. H. S.

Mail Room,
May 27, 1904,
U. S. Patent Office.

Serial No. 210,138, Paper No. ½.

Application.

Petition.

To the Commissioner of Patents:

Your petitioner, Alfred Schwarz, a subject of the Emperor of Germany and a resident of the Borough of Manhattan, City, County and State of New York, and whose Postoffice address is No. 44 Broad Street, in the said City and State of New York, prays that Letters Patent may be granted to him for the new and useful improvements in the Process of Concentrating Ores set forth in the annexed
1904 specification; and he hereby appoints Charles S. Jones of 141 Broadway in the said City, County and State of New York, his attorney, with full power of substitution and revocation, to prosecute this application, to make alterations and amendments therein, to sign the drawings, to receive the patent and to transact all business in the Patent Office connected therewith.

Signed at New York City, this 16" day of May, 1904.

ALFRED SCHWARZ.

To all whom it may concern, be it known that I, Alfred Schwarz, a subject of the Emperor of Germany and a resident of the Borough of Manhattan, City, County and State of New York, have invented certain new and useful improvements in the Process of Concentrating Ores of which the following is a specification.

My invention has for its object the concentration of ores by the
a hydrocarbon compound
May 10/05. selective action of ^ [an oil liquid.]* Heretofore

the separation of the values in ores has been effected by mixing the pulverized ore with a product resulting from the distillation of petroleum, the ore having been previously mixed with

[*Words and figures enclosed in brackets erased in copy.]

sufficient water to form a freely flowing pulp. The oil in such method exercises the property of attaching itself to and buoying up the metallic constituents of the ore that are suspended in the pulp, but it has little or no effect upon the earthy constituents.

I have found that the efficiency of the selective action of oils generally, either mineral, vegetable or animal, is increased
1905 by the addition thereto of a fatty matter which is solid at normal temperatures as paraffin, stearin or palmitin.

In carrying out my invention I proceed as follows: the ore is first crushed and screened to a convenient size for working and is then thoroughly and intimately mixed with the selective material which in this instance is a compound of a mineral, vegetable or animal oil
such mixture being solid at normal temperatures
May 10/05. and a fatty matter of the character above specified ^. Such material may be readily prepared by dissolving the fatty matter in the oil medium, heat being employed to melt the fatty matter, if necessary, and to maintain the compound in a liquid condition during its incorporation with the pulverized ore. As a specific example of a selective material I prefer crude petroleum, or any of its products to which is added about 9 to 10% by weight of paraffin, such proportion having been found to give good results with a copper sulphide ore.

Any suitable apparatus may be employed to effect the mixture of the ore and selective material, all that is essential being a vessel provided with agitating blades. In such vessel the ore is mixed with sufficient of the selective material into intimate contact will all portions of the ore. The Vessel may be steam jacketed, or otherwise suitably heated, if found necessary to maintain the selective material, to make a thick pasty mass, the agitation being continued long enough to bring the selective material, in a liquid condition. After a complete incorporation of the selective material with the ore, water, preferably under pressure, is injected into the mass by suitably arranged pipes, and agitation continued until the water is distributed throughout the mass. The mass is then allowed to subside
1906 when the selective material with the entrapped metallic constituents of the ore will rise to the top and may be removed in any suitable manner as by floating over the top of the vessel. The values may be separated from the selective material in any suitable or well known manner as, for example, by a centrifugal drum or filter press. The tailings being unaffected by the selective material, will remain in the water and settle to the bottom of the vessel from which they may be drawn off, and if necessary, subjected to further treatment for the recovery of any values they may contain.

In the concentration of ores by the selective action of the compound above described the action is facilitated and
a gaseous fluid such as
May 10/05. better results secured by the injection of ^ air, steam or gas, as carbon dioxide gas, into the mass. This may be done by suitably arranged pipes leading into the bottom or sides of the vessel, the effect of such use of air, steam or gas being to break up and subdivide the mass in a complete and thorough

manner. Furthermore it results in the selective material taking up an appreciable quantity of air or gas, giving a certain amount of sponginess which increases its floating power. After the admission of water, which may be done by suitably arranged pipes, the admission of air, steam or gas may be continued to assist in distributing the water throughout the mass and to effect thorough separation and washing out of the tailings.

In referring to paraffin as a fatty matter it is to be understood that I do so in a popular and not a chemical sense. It is
1907 also to be understood that the proportions of the ingredients of the selective material may be varied to suit the particular ore treated.

Insert B, May 10/05.

What I claim and desire to secure by Letters Patent is:—

Canceled July 22/04.

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1. A selective material for use in the concentration of ores consisting of a mixture of an animal, vegetable or mineral oil, and a fatty matter which is solid at normal temperatures.

2. A selective material for use in the concentration of ores consisting of a mixture of petroleum or any of its products and paraffin.

[Matter enclosed between rules erased in copy.]

Sub. B[1], May 10/05.

---

3. A selective material for use in the concentration of ores consisting of a mixture of petroleum or any of its products and 10% by weight of paraffin.

1. 4. The method of concentrating ores which consists in mixing with the pulverized ore a selective material consisting of an animal, vegetable or mineral oil and a fatty matter which is solid at normal temperatures, then separating said material with the entrapped values from the tailings, and then separating the values from the selective material.

2. [5.]* The method of concentrating ores which consists in mixing with the pulverized ore a selective material consisting of an animal, vegetable or mineral oil and a fatty matter which is solid at normal temperatures, then introducing water into the mass to effect a separation of said material with the entrapped values from the tailings, and then separating the values from the selective material.

1908 3. [6.]* The method of concentrating ores which consists in mixing with the pulverized ore a selective material consisting of an animal, vegetable or mineral oil and a fatty matter which is solid at normal temperatures, subjecting the mass to the action of air, steam or gas, then separating said material with the

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[*Words and figures enclosed in brackets erased in copy.]

entrapped values from the tailings, and then separating the values from the selective material.

4. [7.]* The method of concentrating ores which consists in mixing with the pulverized ore a selective material consisting of an animal, vegetable or mineral oil and paraffin, then separating said material with the entrapped values from the tailings, and then separating the values from the selective material.

5. [8.]* The method of concentrating ores which consists in mixing with the pulverized ore a selective material consisting of an animal, vegetable or mineral oil and paraffin, then introducing water into the mass to effect a separation of said material with the entrapped values from the tailings, and then separating the values from the selective material.

[Matter enclosed between rules erased in copy.]

Insert A, July 2/04.

In testimony whereof I have hereunto signed my name in the presence of two subscribing witnesses:

ALFRED SCHWARZ.

Witnesses:
E. F. PORTER.
CHARLES S. JONES.

1909 STATE OF NEW YORK,
County of New York, ss:

Alfred Schwarz, the above named petitioner, being duly sworn deposes and says that he is a subject of the Emperor of Germany and a resident of the Borough of Manhattan, City, County and State of New York; that he verily believes himself to be the original, first and sole inventor of the improvement in the Process of Concentrating Ores described and claimed in the annexed specification; that he does not know and does not believe that the same was ever known or used before his invention or discovery thereof, or patented or described in any printed publication in any country before his invention or discovery thereof, or more than two years prior to this application, that said invention has not been patented to him or to others with his knowledge or consent in this or any foreign country for more than two years prior to this application; or on an application for a patent filed in any country foreign to the United States by him or his legal representatives or assigns more than twelve months prior to this application, and that no application for patent on said improvement has been filed by him or his legal representatives or assigns in any country foreign to the United States.

ALFRED SCHWARZ.

[*Words and figures enclosed in brackets erased in copy.]

Sworn to and subscribed before me this 16th day of May, 1904.
[SEAL.] E. F. PORTER,
Notary Public, No. 58, Kings Co.

Certificate filed in N. Y. Co.

1910 2–260.

M. E. C.

Div. 25, Room 315.

Address only "The Commissioner of Patents, Washington, D. C."

Paper No. 1.

All communications respecting this application should give the serial number, date of filing, and title of invention.

Department of the Interior,

United States Patent Office.

Washington, D. C., June 27, 1904.
Mailed " " "

Alfred Schwarz, care Chas. S. Jones, New York City:

Please find below a communication from the Examiner in charge of your application, #210,138, filed May 27, 1904, for Process of Concentrating Ores.

F. I. ALLEN,
Commissioner of Patents.

Applicant is required to supply a drawing illustrating a means for carrying out his process.

Division is required, in advance of action upon the merits of the claims, between the process and the product claims. To justify joinder of both product and process claims in one application, the process claimed must be one for the preparation or production of the product claimed. The process in this case is for a use of
1911 the product claimed, and not for the production of the product.

LEWIS B. WYNNE,
Examiner, Division XXV.

T. F. MITCHELL.

Serial No. 210,138, Paper No. 2.

Mail Room,
Jul- 2, 1904,
U. S. Patent Office.

Patent Office,
Jul- 5, 1904,
Division XXV.

Room 315.

Application of Alfred Schwarz, Serial No. 210,138, Filed May 27, 1904, for Process of Concentrating Ores.

Hon. Commissioner of Patents, Washington, D. C.

SIR: Replying to the Examiner's letter of June 27, 1904, please amend the above case as follows:

Add the following claims:

Canceled May 10/05.

A. 6. [9.]* The method of concentrating ores which consists in mixing with the pulverized ore a selective material consisting of petroleum or a product thereof and paraffin, then separating said material with the entrapped values from the tailings, and then separating the values from the selective material.

1912 7. [10.]* The method of concentrating ores which consists in mixing with the pulverized ore a selective material consisting of petroleum or a product thereof and about 10 percent by weight of paraffin, then separating said material with the entrapped values from the tailings, and then separating the values from the selective material.

[Matter enclosed between rules erased in copy.]

Remarks.

Claims 1, 2 and 3 of the present application are for a material for use in the concentration of ores and for that purpose only. Rule 41 clearly recognizes the right of applicant to claim in one application distinct inventions which are dependent upon each other and mutually contribute to produce a single result. That is the precise situation with the present claims. None of the specific clauses of Rule 41 prohibit the joinder in one application of claims for a method and claims for a material used in carrying out that method, nor is applicant aware of any ruling of the Commissioner which prohibits such joinder. A patent issued with the present claims would certainly not be invalid on the ground that the inventions are independent within the meaning of Rules 41 and 42.

[*Words and figures enclosed in brackets erased in copy.]

If the Examiner insists upon his requirement for division, he is requested in accordance with the usual practice of the Office, to give applicant the benefit of a cursory examination in order to enable him to properly divide.

The drawing requested by the Examiner will be furnished in due time.

1913 A reconsideration and allowance of the case is requested.

Respectfully submitted,

CHARLES S. JONES,
Atty. for Applicant.

Dated New York City, N. Y., July 1, 1904.

2–260.

M. E. C.

Div. 25, Room 315.

Address only "The Commissioner of Patents, Washington, D. C."

Paper No. 3.

All communications respecting this application should give the serial number, date of filing, and title of invention.

Department of the Interior,

United States Patent Office.

Washington, D. C., July 12, 1904.
Mailed " "

Alfred Schwarz, care Chas. S. Jones, New York, N. Y.:

Please find below a communication from the Examiner in charge of your application, #210,138, filed May 27, 1904, for Process of Concentrating Ores.

F. I. ALLEN,
Commissioner of Patents.

Case as brought up by amendment and argument filed July 2, 1904, considered.

1914 The requirement for division is repeated and made final. See ex parte Tschirner, C. D., 1901, 141.

References were not cited in the first office letter partly because the independence of the inventions appeared so clear, (ex parte Reid, C. D., 1901, 123,) and partly because applicant's attorney already possessed the data available to the examiner, as exhibited at personal interview between attorney and examiner just prior to the filing of this application. However, the following are cited: 348,157, Everson, Aug. 24, 1886, Metallurgy, Reducing, Refining, Separating, 471,174, Hebron & Everson, March 22, 1892; 575,669, Robson, Jan. 19, 1897; and 676,679, Elmore, June 18, 1901, Washers, H.

Applicant's response should either cancel the claims to one invention or take the question of division before the Hon. Examiners-in-Chief on appeal.

LEWIS B. WYNNE,
Examiner, Division XXV.

T. F. MITCHELL.

1915 Serial No. 210,138, Paper No. 4.

Mail Room,
Jul- 22, 1904.
U. S. Patent Office.

Patent Office,
Jul- 23, 1904,
Division XXV.

Room 315.

Application of Alfred Schwarz. Serial Number 210,138. Filed May 27, 1904. Process of Concentrating Ores.

Hon. Commissioner of Patents.

SIR: Replying to the Examiner's letter of July 12, 1904, please amend the above application as follows:

Cancel claims 1, 2 and 3 and change the ordinals of the remaining claims accordingly.

Remarks.

The above amendment restricts the present application to the method of concentrating ores. Claims 1, 2 and 3 have been canceled without waiver of the right to present them in a separate application.

An early action on the merits is requested.

Dated New York, July 21, 1904.

Respectfully submitted,

CHARLES S. JONES,
Atty. for Applicant.

1916 2–260.

M. E. C.

Div. 25, Room 315.

Address only "The Commissioner of Patents, Washington, D. C."

Paper No. 5.

All communications respecting this application should give the serial number, date of filing and title of invention.

Department of the Interior,

United States Patent Office,

Washington, D. C., Aug. 16, 1904.
Mailed " " "

Alfred Schwarz, care Chas. S. Jones, New York City:

Please find below a communication from the Examiner in charge of your application, #210,138, filed May 27, 1904, for Process of Concentrating Ores.

F. I. ALLEN,
Commissioner of Patents.

Case as amended July 22, 1904, further considered.

Claim 1 is objectionably alternative by reason of "animal, vegetable or mineral oil," line 3. The claim is rejected as failing to express anything patentable over 348,157, Everson, of record. See page 2, lines 71-74. The mixture of petroleum with tallow
1917 and the procedure indicated for the separation completely anticipate this claim.

Claim 2 is alternative in the same manner as claim 1 and is rejected upon the same reference.

Claim 3 is alternative in the same manner as claim 1 and also by reason of "air, Steam or gas," line 5. Said claim is rejected in view of Everson, of record, and 745,960, Good, Dec. 1, 1903, Washers, H.—see 32*a* thereof—or British patent 12,778, Lake, June 4, 1902, Washers.

Claims 4 and 5 are objectionably alternative in the same manner as claim 1, and are rejected upon the same reference.

Claims 6 and 7 are alternative as to "petroleum or a product thereof." They do not express anything patentable over Everson or Elmore of record, for the reason that Elmore's product ("residuum") is a mixture of petroleum or a product thereof and paraffin.

LEWIS B. WYNNE,
Examiner, Div. XXV.

T. F. MITCHELL.

1918 Serial No. 210,138, Paper No. 6.

Patent Office,
May 10, 1905,
Division XXV.

Room 315.

Application of Alfred Schwarz. Serial No. 210,138. Filed May 27, 1904. Process of Concentrating Ores.

Hon. Commissioner of Patents, Washington, D. C.

SIR: Replying to the Examiner's letter of August 16, 1904, please add the accompanying sheet of drawings.

Page 1 of the specifications, line 2, cancel "an oily liquid" and substitute therefor "a hydrocarbon compound."

Same page, line 22, after "specified" insert "such mixture being solid at normal temperatures."

Page 2, line 2 from the bottom, before "air" insert "a gaseous fluid such as."

At the end of the specification, page 3, add the following:—

B. "The accompanying drawing shows in perspective one arrangement of apparatus by which the process may be carried out. 1 designates a bin or hopper from which the pulverized ore is discharged into a vessel 2 which is preferably steam jacketed and provided with an agitator 3. In
1919 this vessel the ore and selective agent are intimately mixed, and from said vessel the mass is discharged into a vessel 4 provided with an agitator in which it is treated with water slightly acidulated if desired to effect the separation of the selective agent with the entrapped metallic constituents from the tailings. If cold water is employed the selective agent will be solidified and rising to the top is conducted by a trough 5 to remelting and storage vessel 6. If heated or boiling water is employed in the vessel 4 the selective agent will be maintained in its liquid condition, and as it rises with the entrapped metallic constituents is run by the trough 5 into the storage vessel 6, and from the latter to a centrifugal drum 7 for the separation of the values from said agent. The recovered agent is collected in a storage vessel 8 from which it may be raised to the mixing vessel 2 by a pump 9. The separating vessel 4 is provided with suitable pipes 10 for the admission of air, steam or gas and with a pipe 11 by which the tailings may be discharged into a vessel 12. After removal of the values from the separator 7 they may be subjected to any suitable treatment.

Cancel the present claims and substitute therefor the following:—

B[1]. "1. The process of concentrating ores consisting in mixing with the pulverized ore a selective agent consisting of a mixture of a liquid hydrocarbon and a normally solid fatty matter which mixture is solid at normal tempera-
1920 tures, separating said agent with its entrapped values from the tailings, and finally recovering the values from the selective agent.

2. The process of concentrating ores consisting in mixing with the pulverized ore a selective agent consisting of a mixture of liquid hydrocarbon and a normally solid fatty matter which mixture is solid at normal temperatures, treating the mass with water to separate said agent with its entrapped values from the tailings, and finally recovering the values from the selective agent.

3. The process of concentrating ores consisting in mixing with the pulverized ore a selective agent consisting of a mix-

ture of liquid hydrocarbon and a normally solid fatty matter which mixture is solid at normal temperatures, treating the mass with cold water to separate said agent with its entrapped values from the tailings, and finally recovering the values from the selective agent.

4. The method of concentrating ores consisting in mixing with the pulverized ore a selective agent consisting of a mixture of a liquid hydrocarbon and a normally solid fatty matter which mixture is solid at normal temperatures and subjecting the mass to the action of a gaseous fluid, separating the selective agent with its entrapped values from the tailings, and finally recovering the values from the selective agent.

5. The process of concentrating ores consisting in mixing with the pulverized ore a selective agent consisting of a mixture of a liquid hydrocarbon and paraffin which mix-
1921 ture is solid at normal temperatures, separating said agent with its entrapped values from the tailings, and finally recovering the values from the selective agent.

6. The process of concentrating ores consisting in mixing with the pulverized ore a selective agent consisting of a mixture of a liquid hydrocarbon and paraffin which mixture is solid at normal temperatures, treating the mass with water to separate said agent with its entrapped values from the tailings, and finally recovering the values from the selective agent."

Remarks.

The above amendments have been made in accordance with the Examiner's letter of August 16th, 1904, and in view of a recent personal interview. The claims as now drawn, it is thought, avoid the references of record as they are modeled after patent 771,277 issued to the Schwarz Ore Treating Company, the owner of the present application.

Patent to Everson 348,157 is for the use of emulsions of fats and oils thickened or acidulated by chemical reagents, the silica being removed by a subsequent washing operation. The present claims are restricted to the use of an agent consisting of a mixture of a liquid hydrocarbon and a normally solid fatty matter which mixture is solid at normal temperatures.

Patent to Good 745,960 mentions in one place the use of oil.
1922 No where, however, does Good state why the oil is added or what function it performs.

None of the Elmore patents disclose the present specific selective agent.

A reconsideration and allowance of the case is requested.

Respectfully submitted,

CHARLES S. JONES,
Atty. for Applicant.

Dated New York City, N. Y., April 28, 1905.

2–181.

A. S. W.

Serial No. 210,138.

Issue Division.

All communications should be addressed to "The Commissioner of Patents, Washington, D. C."

Department of the Interior,

U. S. Patent Office,

Washington, D. C., July 6, 1905.

Alfred Schwarz, assor., c/o Chas S. Jones, 141 Broadway, New York, N. Y.

SIR: Your Application for a patent for an Improvement in Process of Concentrating Ores filed May 27, 1904, has been examined and allowed.

1923 The final fee, Twenty Dollars, must be paid, and the Letters Patent bear date as of a day not later than six months from the time of this present notice of allowance.

If the final fee is not paid within that period the patent will be withheld, and your only relief will be by a renewal of the application, with additional fees, under the provisions of Section 4897, Revised Statutes. The Office aims to deliver patents upon the day of their date, and on which their term begins to run; but to do this properly applicants will be expected to pay their final fees at least twenty days prior to the conclusion of the six months allowed them by law. The printing, photolithographing, and engrossing of the several patent parts, preparatory to final signing and sealing, will consume the intervening time, and such work will not be done until after payment of the necessary fees.

When you send the final fee you will also send, distinctly and plainly written, the name of the inventor and title of invention as above given, date of allowance (which is the date of this circular), date of filing, and, if assigned, the names of the assignees.

If you desire to have the patent issue to assignees, an assignment containing a request to that effect, together with the fee — recording the same, must be filed in this Office on or before the date of payment of final fee.

After issue of the patent uncertified copies of the drawings
1924 and specifications may be purchased at the price of 5 cents each. The money should accompany the order. Postage stamps will not be received.

Respectfully,

F. I. ALLEN,
Commissioner of Patents.

After allowance, and prior to payment of the final fee, applicants should carefully scrutinize the description to see that their statements and language are correct, as mistakes not incurred through the fault of the office, and not affording legal grounds for reissues, will not be corrected after the delivery of the letters patent to the patentee or his agent.

In remitting the final fee give the serial number at the head of this notice.

If payment is made by check or draft, the credit allowed is subject to the collection of the same.

1925 2–103.

$20 received as the final fee in the application of A. Schwarz 210,138 for Process of Concentrating Ores applied from a composite letter No. 219,761 received Nov. 25, 1905, from Jones C. S. which is on file in the Chief Clerk's room. B./M. R.

J. W. BABSON,
Chief of Issue and Gazette Division.

J. J. D.

2–191.

S. M.

Issue Division.

Serial No. 210, 138.

Address only "The Commissioner of Patents, Washington, D. C."

Department of the Interior,
United States Patent Office,
Washington, D. C., Nov. 25, 1905.

Alfred Schwarz, Assor., c/o Chas. S. Jones, 141 Broadway, New York, N. Y.

SIR: You are informed that the final fee of twenty dollars has been received in your application for Improvement in Process of Concentrating Ores.

Very respectfully,

F. I. ALLEN,
Commissioner of Patents.

[Here follows printed copy of Patent 807,503.]

1926

1904.

83. Mills.
Ore and Coal Washers.

Contents.

Print, —— —, ——.
Application, — papers.
1. Letter, –:– June 27, 1904.
2. Amendment A, July 2, 1904.
3. Letter, –:– July 12, 1904.
4. Amendment, July 22, 1904.
5. Rej., Aug. 16, 1904.
6. Amendment B, May 10, 1905.
7.
8.
9.
10.
11.
12.
13.
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15.
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21.
22.
23.

Title: Improvement in Process of Concentrating Ores.

1927

DEFENDANT'S EXHIBIT.

Certified Copy of File-wrapper and Contents of Kirby Patent No. 809,959.

United States of America,

Department of the Interior,

United States Patent Office.

To all to whom these presents shall come, Greeting:

This is to certify that the annexed is a true copy from the Records of this Office of the File Wrapper and Contents, in the matter of the

uary 16, 1906, for Improvement in Processes of Separating Minerals. Letters Patent of Edmund B. Kirby, Number 809,959, Granted Jan-

In testimony whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed at the City of Washington, this 3rd day of June, in the year of our Lord one thousand nine hundred and twelve and of the Independence of the United States of America the one hundred and thirty-sixth.

[SEAL.]

F. A. TENNANT,
Acting Commissioner of Patents.

1928

2-437.

Number (Series of 1900).
185,033.

1903.

Div. 25.
(Exr.'s Book) 38-115.

Divn. XXV.

Patent No. 809,959.
Name: Edmund B. Kirby, of Rossland,
Province of British Columbia, Canada.
Invention: Process of Separating Minerals.

		Original.	Renewed.
Parts of application filed.	Petition,	Dec. 14, 1903,	—— —, 190-.
	Affidavit,	" " 1903,	—— —, 190-.
	Specification,	" " 1903,	—— —, 190-.
	Drawing, 3 shts.,	" " 1903,	—— —, 190-.
	Model or Specimen not reqd.,	—— —, 190-,	—— —, 190-.
	First Fee, Cash $15,	Dec. 14, 1903,	—— —, 190-.
	1. " " Cert.,	—— —, 190-,	—— —, 190-.
	Appl. filed complete,	Dec. 14, 1903,	—— —, 190-.
Examined, Lewis B. Wynne, Ex.,		June 29th, 1905,	—— —, 190-.
Countersigned, J. W. Babson, For Commissioner.		—— —, ——,	—— —, 190-. For Commissioner.
Notice of Allowance,		July 10, 1905,	—— —, 190-.
Final Fee, Cash $20,		Dec. 23, 1905,	—— —, 190-.
2. " " Cert.,		—— —, 190-,	—— —, 190-.

Patented, January 16, 1906.
Dec. 23, 1905.

Associate Attorney, —— ——. Attorneys, Thurston & Bates,
1028 Society for Savings Bldg., Cleveland, Ohio.

3. Name, —— ——. Serial Number, ——.
Patent No. —. Date of Patent, ——.

[On left margin:] Division of App., No. —, filed —— —, 190-.

1929 $15, ck., Received Dec. 14, 1903. L. Z. A. Chief Clerk, U. S. Patent Office.

Cleveland, Ohio, Dec. 12, 1903.

Commissioner of Patents, Washington, D. C.

DEAR SIR: In the matter of the application about to be filed by Edmund B. Kirby for Process of Separating Minerals executed Dec. 4, 1903, we hand you herewith by mail the following—

Petition and Power of Attorney,
Specification,
Oath,
3 Sheets of Drawings.
Government Fee: $15.00, enclosed in our check.

Yours truly,

THURSTON & BATES.

Mail Room,
Dec. 14, 1903,
U. S. Patent Office.

Serial No. 185,033, Paper No. ½.

Application. 1903.

To the Commissioner of Patents:

Your petitioner, Edmund B. Kirby, a citizen of the United States, residing at Rossland, in the Province of British Columbia and Dominion of Canada, whose Post Office address is Rossland, British Columbia, Canada, prays that Letters Patent may be granted
1930 to him, for the improvement in process of separating minerals set forth in the annexed specification.

And he hereby appoints the firm of Thurston & Bates, (Reg. #1130), of Cleveland, Ohio, (said firm consisting of E. L. Thurston and Albert H. Bates) his attorneys, with full power of substitution and revocation, to prosecute this application, to make alterations and amendments therein, to sign the drawings, to receive the patent, and to transact all business in the Patent Office connected therewith.

Signed at Northport, in the County of Stevens and State of Washington, this fourth day of Dec. 1903

EDMUND B. KIRBY.

Specification.

To all whom it may concern:

Be it known that I, Edmund B. Kirby, a citizen of the United States, residing at Rossland, in the Province of British Columbia and Dominion of Canada, have invented a certain new and useful improvement in process of separating minerals, of which the follow-

ing is a full, clear and exact description, reference being had to the accompanying drawings.

The invention relates to the concentration of ores. It may be employed to separate the metallic minerals from the gangue or to separate certain of the metallic minerals from others, or from others and the gangue. The operation of the process is dependent upon
the fact that, because of differences in physical characteri ties
1931 of the various constituents of mineral material, such constituents show preferences of adhesion between two commingled, but immiscible liquids.

The invention consists in the process hereinafter described, and in the several steps thereof,—all of which will be definitely set forth in the claims.

In the drawings, figure 1 is a diagrammatic view of an apparatus with which the process may be practiced,—the several parts thereof being shown in vertical section; figure 2 is a plan view of one side of the separating tank; figure 3 is a vertical sectional view of the same mechanism; figure 4 is an elevation of a part of the agitator mechanism of the separating tank,—some of said mechanism being in section; and figure 5 is a plan view of one of the agitator arms, and a sectional plan view of the shaft.

The process is applicable to a great variety of ores, and may be practiced, in many cases, so as to separate those metallic minerals which must be treated in one way from those which must be treated in some other way in order to recover their contained commercial metals; and, since it is capable of being used for this purpose as well as to separate the metallic minerals from the gangue, it is thought to be a great step in advance of this art.

It is believed that the process or some of the novel steps thereof may be employed with advantage in the tratment of all ores. It is obviously impossible, however, to give definite directions for attaining
the best results with all ores, because of the great chemical
1932 and physical differences which they exhibit. The detailed directions hereinafter set forth are those which are found most efficient in the treatment of the Rossland, B. C., ores, with which I have done the most work, for the primary purpose of separating the chalcopyrite (which must be smelted) from the other constituents which may be subjected to other after treatment for the recovery of their contained metals.

The process, as an entirety, in its best form for use with Rossland ores for the purpose stated, consists in the following steps.

First, in thoroughly agitating together (*a*) the pulverized ore or mineral material, (*b*) enough water to make with said pulverized ore a flowing pulp, and (*c*) a solution of bitumen in a thin distillable hydro-carbon liquid as kerosene;—these materials to be so thoroughly agitated together as to finely subdivide said solution into small globules, and bring said globules into contact with substantially all of the pulverized mineral particles which will, by preference, adhere to them.

Second, in allowing the hydrocarbon coated particles to float to the surface of the mass, and in rendering this separation substantially

complete by gently agitating the mass, and by injecting gas into the same, and, preferably also discharging into the mass fine streams of the solution. When the separation is completed the floating hydrocarbon coated concentrate is removed for subsequent treatment.

Third in filtering said concentrate to free it so far as possible, from the hydrocarbon liquid.

1933 Fourth, in distilling said coated concentrate, and condensing the hydrocarbon vapor, to be used again.

It is thought that the use of a gas to assist in the flotation of the coated particles, as set forth in the description of the second step of the process, is radically new in this art, irrespective of its association with the other steps described. It is that which makes it possible for the first time to use thin oils and hydrocarbon. The prior processes which use thick, viscous oils will, however, be much aided by the addition of this step, because, in spite of all the care which is exercised in the practice of those processes to keep the oil in large clots or masses, a great deal of it is "floured" or broken up into minute particles which are trapped in the sands and lost. The employment of the gas in the manner stated brings in a more powerful floating agency than anything before used, which results in the recovery of this "floured" oil together with numerous coated particles which would not otherwise be floated. This step of the process is therefore useful with any and all liquids lighter than water which exhibit preference of adhesion for the metalic mineral particles. Kerosene alone for example may be used with most ores to take out the sulphides, provided the gas is used as stated to cause the flotation of the kerosene coated particles.

It is the bitumen, however, dissolved in the kerosene which gives the precise adhesive preference which enables it to separate the gold and chalcopyrite from the crushed ore. The bitumen may be asphalt, or the bitumen produced by the distillation of petro-

1934 leum to a semi-solid residuum; or it may be tar, pitch, or any other specific form of bitumen. In treating Rossland ores I have found that the most satisfactory results have been attained by using a solution obtained by dissolving in kerosene above 5 per cent., or thereabout, of Trinidad asphalt, or the semi-solid residuum of petroleum distillation. Preferably the pulverized ore is mixed with three to five times as much water, by weight, and to this is added a sufficient amount of the kerosene-bitumen solution; excellent results being obtained by using one-fourth to three-fourths as much, by weight, as ore.

The preference of the solution for some of the mineral particles may be regulated by altering or varying the quantity of the solute substance, and by varying the temperature at which the solution is used. The preference of the water for other mineral particles may be regulated by adding some acid or other chemical. A distinct advantage of using a light hydrocarbon, like kerosene, is that so much of it as cannot be removed from the concentrate by mechanical means may be recovered by a process of distillation,—this method of recovery being impossible when thick non-distillable oils are used.

The injection of a gas, preferably air, into the mass,—which is the

chief novel characteristic of the second step of the process, assists in the flotation of the hydrocarbon coated particles. This makes it possible to finely subdivide the solution by the agitation, and
1935 this greatly increases the chance that all of the mineral particles which exhibit preferential adhesion for it, shall be brought into contact with it. Some of the hydrocarbon coated particles will float to the surface without assistance; but, a considerable quantity of such particles will not be sufficiently buoyant and some of such particles and some globules of the mixture would be trapped in the sands. In order to recover this less buoyant material together with the globules of the mixture, the mass, which tends to settle, is slowly lifted and turned over to liberate the coated particles, and the globules, and, at the same time a gas, preferably air, is blown into the mass, preferably near the bottom thereof. The air bubbles not only tend to attach themselves directly to the coated particles and thus float them to the surface, but the air becomes dissolved in the water to its maximum capacity. This dissolved air tends to again separate itself from the water, and attach itself in minute globules to the coated particles. I find that air, carbon dioxide, hydrogen, and marsh gas are satisfactory for this purpose; and doubtless many other or all gases will operate in the same way,—but I prefer air.

It might be here added that because the solution is broken up into small globules there is little likelihood that any of the non-coated particles shall be entangled with the coated concentrates and carried to the surface.

In removing this floating, hydro-carbon-coated concentrate it is practically impossible to exclude some of the water in which
1936 the non-coated particles are held in suspension. It is therefore desirable that this concentrate shall be washed free from such non-coated minerals. This step is not, however, absolutely essential. It is possible to remove a very large part of the hydrocarbon by filtration because of its thin character. It is not, however, possible to remove it all by this, or any other mechanical process; but because of the character of the hydrocarbon solvent used it is possible to recover all of it for future use by a process of distillation which constitutes the fourth step of the complete process.

I will now describe the apparatus shown in the drawing for practically carrying on said process. A represents the mixing tank; B represents the separating tank; C represents the settling tank; D represents the filter, and E another filter which may or may not be used according to circumstances; G represents a settling box or tank into which the liquid from the filter or filters is discharged; H represents the retort furnace; I the dust collector used in connection therewith; J a condenser; K the settling tank in which the condenser discharges the condensed vapor; and M represents a reservoir from which the solution may be fed into the mixing tank and into the separating tank.

In the separating tank B is a vertical shaft *b* having on its upper end a gear *b'* by which it may be rotated. The head of the shaft above the driving gear passes through an oil and air box 1 which remain- stationary while the shaft revolves, and is supplied by

1937 the hydrocarbon pipe (2) and the air pipe (3). The box rests on the rotating shoulder (4) of the shaft, and is held down to a tight joint by the collar (5) and lock nut cap (6). Through the hollow shaft (7) extends a small hydrocarbon pipe (8), the upper end of which is firmly inserted within the upward extension (10) of the shaft, and this central pipe conveys the hydrocarbon. In the stationary box the air enters the annular chamber (11), passing through its open bottom through a set of apertures (12) to the interior of the shaft. The hydrocarbon enters a similar annular chamber (13), from which it passes by aperture (14) into the top of the central hydrocarbon pipe.

The hub and revolving arms are shown in Figs. 4 and 5. The step bearing is supported on a pedestal (15) provided with a wooden block (16) which supports the moving wearing plate (17) of the shaft. Lubricating water under pressure is introduced through the pipe (18), finding its way out from the bearing through side grooves, (50). The sides (19) of the shaft are carried down below the bearing so as to leave an annular space (20) between them and the pedestal. This annular space is intended to constitute an air bell, designed to assist the lubricating water in excluding sand from the bearing. The air supply in it is maintained by a slight stress of air which escapes beneath the bell through the pipe (21).

The air current for the charge passes down through the shaft, passing (as shown by the arrows) through the side channels (22) into the hollow arms (23), (23). From each arm it passes
1938 out through drop pipes (24) (24).

The hydrocarbon liquid is delivered through small pipes, parallel with said hollow arms, emerging at the outlets (25) (25). The
radially
Mar. 24/05. ∧ [raidally]* scraping blades (26) (26) are secured to the arms (23), and also the inclined lifting plow (27) at the extremity of the said arms, this being so set as to force the circulation upwards at this point.

The rotary movement of the charge leads the floating scum of hydrocarbon liquid, air bubbles and concentrates against the
curved
Mar. 24/05. ∧ [spiral]* skimming bar (28) which is hung so as to arrest and deflect this floating layer and cause it to pass into the settling and washing chamber or box (29). The edge of this box outside of the skimming bar is submerged sufficiently to allow the floating material to pass over it while the remaining part of said edge is raised above the liquid so as to detain everything passing into it. Owing to the agitation within the tank caused by the movement of the arms (23) and the rising air bubbles, the water even near the top is not clear, but turbid or muddy with slimes or fine particles of the non-coated minerals, which do not settle rapidly enough to get out of the way. The floating concentrates are carried mainly at the lower surface of the hydrocarbon layer where it is in contact with the water. The discharge gate

[*Words and figures enclosed in brackets erased in copy.]

(32) in order to permit these floating particles to pass out, must be set low enough to clear them, and must therefore allow portion of the water to pass out with the skimmings, and this muddy
1939 water would therefore carry its suspended particles of the worthless minerals which would make the concentrates impure.

The settling and washing chamber or box is designed to lessen or prevent this evil. As the floating material passes over its submerged edge (29) (30) it escapes from the swift current and rising air bubbles, so that in its comparative quiet, the slimes have a better opportunity to settle out of the way. The bottom of the box is divided as convenient into compartments by submerged partitions, as shown, each compartment terminating in a hopper shape bottom, with discharge openings (33) through which the settled slimes may pass out again into the tank. Projecting shields (34) prevent the air bubbles from entering the hoppers and disturbing their quiet.

The passage of the floating material over this quiet chamber or box settles most of the slimes before reaching the adjustable discharge gate or outlet (32). Before reaching the gate, however, the skimmings pass over stream of clean wash water, introduced at the point (35) through the pipe shown. This washwater is delivered under constant head from supply tank. Its quantity is made exactly equal to that passing out through the discharge gate with the skimmings; so that this discharge, being supplied entirely by the pure water close at hand, contains little or none of the muddy water which is thus held back in the tank. It is evident that the incoming and outgoing streams are self-adjusting, because if too much
level
Mar. 24/05. 1940 enters, the general ∧ [level]* rises and a large stream flows from the orifice.

In the mixing tank a vertical rotating shaft *a* is mounted having preferably a lower bearing similar to that which is provided for a shaft *b* and which has been described. Arms *a'* are attached to the shaft near its lower end, and lifting plows are secured to the outer parts of these arms, and radial plows to the other parts thereof just as in the separator tank. This shaft *a* is to be rotated rapidly, and the result is a thorough commingling of the various parts of the charge,—which result is facilitated by the currents created in the charge by the action of said plows,—the direction of said currents being indicated by the arrows in figure 1.

This separate tank for performing the mixing operation is not necessary for my process although it is preferable in some cases as when a continuous discharge is desired. The mixing may be performed just as well in the separating tank which may then be termed the "Mixing and Separating tank." It is merely necessary to rotate the agitating mechanism rapidly while mixing and to rotate it slowly while the separation is being made.

The material skimmed from the surface of the separating tank may pass directly to the filter D or E, but it is best to discharge it

[*Words and figures enclosed in brackets erased in copy.]

into the settling tank C in order to separate the main bulk of water and thus reduce the bulk of liquid to be put through the filtering operation.

As explained, this is not essential, but is conveniently introduced prior to the filtration, merely in order to separate the main
1941 bulk of water, and thus reduce the bulk of fluid to be put through the filtering operation. It is thus merely a convenience. The settling tank C is shown as a cylindrical vessel, with hopper shape bottom, within which is suspended a cylinder (41) reaching half way down. The stream of skimming enters this central cylinder, within which the water and hydrocarbon separate, the former sinking, while the latter, with its accompanying concentrates and air bubbles, floats in a layer, as shown. The stirring apparatus (42) has its arms revolving gently within this layer, so as to break up and discharge air bubbles and assist the separation. Most of the concentrates hang near the contact between the hydrocarbon and water, and as this contact surface becomes overloaded with concentrates, some of them sink to the bottom of the tank. The excess of hydrocarbon, accompanied by some of the concentrates, flows out through the launder (43) while the excess of water, passing beneath the suspended internal cylinder, passes out through the overflow (44), and thereby lessens the volume to be filtered. The concentrates which fall to the bottom of the tank, accompanied by the hydrocarbon which adheres to them, are drawn off in a thick condition through the pipe (45), the discharge end of which is raised to prevent the exit of more water than necessary. The two streams, one of hydrocarbon and concentrates, the other mainly of water and concentrates, may either be filtered in separate apparatus or united and put through the same apparatus, as is found most
1942 convenient. Hydrocarbon liquid and concentrates filter more easily than when water is present, and it may therefore be desirable to filter separately. It is for this reason that two filters D and E are shown,—the one receiving such material as flows from the surface of the tank through launder (43), and the other that material which is discharged through pipe (45). I do not restrict myself to any particular form of filtering appliance.

The use of thin hydrocarbon liquid in place of the thick viscid oil used by other inventors, makes filtration comparatively easy, and permits the use of more simple and cheap methods than the centrifugal machine or filter presses. The use of such simple apparatus is also made possible by the fact that it is not now necessary to separate the liquid very thoroughly, since its extraction is to be perfected in the distillation retorts. I find that in some case it is sufficient to use a simple open filter tank, with a porous bottom of any of the well-known kinds, preferably light canvas resting on suitable supports. The liquid and water drain through the porous bottom, leaving the concentrates in the tank, sufficiently drained to be shoveled into the retorts. The passage of the liquid and water through the porous bottom is aided by the well-known means of a vacuum pump N beneath. The filter indicated by E is a pressure filter barrel of well known construction which need not be here explained, and may

be used when forced filtration is necessary. It is shown to emphasize the fact that the operation of the process is not restricted
1943 to any specific kind of filter, or to any number of filters.

The mixture of hydrocarbon liquid and water, now free from solid matter, is of course self-separating in any receptacle. A convenient form is shown in the settling box G, into which said mixture is delivered through suitable pipes from both filters. The hydrocarbon liquid remains in one compartment g, from which it overflows and is returned to the reservoir. The water, sinking to the bottom, passes under the partition g' to the other compartment and flows to waste.

The filtered concentrates, containing some residual liquid and moisture, are now ready for the distilling operation, for the recovery of the five per cent or more of valuable hydrocarbon liquid remaining in them. This is done in the retort furnace H. An iron retort (46) is set in a furnace at such an angle that the concentrates will pass down through it by gravity, but will not altogether close the upper side of the channel, which should remain more or less open, for the exit and passage of the steam and hydrocarbon vapors. The retort is maintained at the distillation temperature of the hydrocarbon used, which in the case of kerosene is about 338 degrees F. In order to assist in carrying off the hydrocarbon vapor, a current of superheated steam is introduced at (47), while the steam and hydrocarbon vapors pass off through the pipe at (48) to the condensing apparatus. The dry concentrates on losing their liquid and moisture slide down to the lower end of the retort, where they are
1944 drawn off through the double gates (49) (49) which are opened alternately so as to prevent the escape of vapors. As concentrates are drawn off below a fresh mass is introduced above, by the alternate opening of the gates (50) (50), which likewise prevent the escape of vapors. An additional seal is provided by the hopper (51) which is kept filled with concentrates. The steam and hydrocarbon vapors may be led through a dust collecting chamber I, designed to settle and collect any concentrates dust carried over, and then passes to the condenser J. This includes a metal worm or coil (53) set in a tank through which a stream of cooling water is allowed to flow. The condensed hydrocarbon and water, passing through a "U" trap (54) flow into a settling box K similar to the one described at "G." Here the hydrocarbon liquid and water separate, and the former is returned to the reservoir M for re-use, as is also the liquid recovered in the settling tank G.

Having described my invention, I claim:

Canceled June 26/05.

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1. The process of separating minerals, which consists in mixing together (*a*) pulverized mineral material, (*b*) a considerable quantity of water, and (*c*) a substance immiscible in water but of less specific gravity, and which, in the presence of water, will adhere to some of the mineral particles and not to others; in removing from the sur-

face of the mass the floating immiscible substance and the mineral particles to which it has adhered; in filtering the material so removed; and in distilling the concentrate residue [filtrate]* to drive off and recover said immiscible substance, substantially as specified.

Mar. 24/05.
1945

2. The process of separating minerals, which consists in mixing together pulverized mineral material, a considerable quantity of water, and a substance immiscible in water but of less specific gravity, and which, in the presence of water, will adhere to some of the mineral particles and not to others; in gently agitating the mass and blowing into the same a gas to assist the flotation of said immiscible substance and the mineral particles which have become coated therewith; in removing the floating layer; and separating said adhering substance from said mineral particles, substantially as specified.

[Matter enclosed between rules erased in copy.]

1. [3.]* The process of separating minerals, which consists in mixing together pulverized mineral material, a considerable quantity of water, and a substance immiscible in water, but of less specific gravity, and which will, in the presence of water, adhere to some of the mineral particles and not to others; in violently agitating the mass so as to break up said immiscible substance into minute globules; in allowing said mass to settle whereby a considerable quantity of the mineral particles having become coated with said substance will float to the top of the mass, and in gently agitating the portion thereof which settles, and in blowing into the same a gas for the purpose of assisting the flotation of said substance and the mineral particles coated therewith; in removing the floating layer, and in separating the mineral particles from said immiscible substance, substantially as specified.

1946 Canceled June 26/05.

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4. The process of separating ores, which consists in thoroughly mixing together pulverized mineral material, a considerable quantity of water, a thin liquid hydrocarbon which will adhere to some of the mineral particles and not to others; in gently agitating the mass and blowing gas into the same for the purpose of assisting the flotation of said hydro-carbon and the mineral particles which have been coated thereby; in removing the floating layer; and separating said mineral particles and hydro-carbon, substantially as specified.

5. The process of separating ores, which consists in thoroughly mixing together pulverized mineral material, a considerable quantity of water, and a thin hydro-carbon liquid which will adhere to some of the mineral particles but not to others; in gently agitating the mass and blowing gas into the same for the purpose of assisting the flotation of said hydro-carbon liquid and the mineral particles which

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[*Words and figures enclosed in brackets erased in copy.]

have become coated thereby; in removing the floating layer; and in filtering the same, substantially as specified.

6. The process of separating ores, which consists in thoroughly mixing together pulverized mineral material, a considerable quantity of water, a thin liquid hydro-carbon which will adhere to some of the mineral particles but not to others; in gently agitating the mass and blowing gas and some of said hydro-carbon liquid into the same for the purpose of assisting the flotation of said hydro-carbon liquid and the mineral particles which have become coated thereby; in removing the floating layer; and in filtering the same, sub-
1947 stantially as specified.

7. The process of separating ores, which consists in thoroughly mixing together pulverized mineral material, a considerable quantity of water, a distillable hydro-carbon liquid which will adhere to some of the mineral particles but not to others; in gently agitating the mass and blowing gas into the same for the purpose of assisting the flotation of said hydro-carbon and the mineral particles which have become coated thereby; in removing the floating layer; concentrate residue
Mar. 24/05. in filtering the same; and finally in distilling the ∧ [filtrate]* and condensing the hydro-carbon vapors driven off, substantially as specified.

[Matter enclosed between rules erased in copy.]

4. [10.]* The process of separating minerals, which consists in
2. [8.]* The process of separating ores, which consists in mixing together pulverized mineral material, a considerable quantity of water, and a solution of bitumen in a light hydro-carbon liquid ∧;

Insert A, Mar. 24/05.>

in violently agitating this mixture to break up said solution into fine globules; in allowing the mass to settle, and then gently agitating the same and blowing in gas to insure the flotation of said solution and the mineral particles coated thereby; in removing the floating layer; and separating the mineral particles from the solution, substantially as specified.

3. [9.]* The process of separating ores, which consists in mixing together pulverized mineral material, a considerable quantity
1948 of water, and a solution of bitumen in a light hydro-carbon liquid ∧; in violently agitating this mixture to break up said

Insert A, Mar. 24/05.>

solution into fine globules; in allowing the mass to settle, and then gently agitating the same and blowing into it a gas and some of the said solution to insure the flotation of said solution and the mineral particles coated thereby; in removing the floating layer; and separating the mineral particles from the solution, substantially as specified.

[*Words and figures enclosed in brackets erased in copy.]

mixing together the pulverized mineral material a considerable quantity of water, and a solution of bitumen in a light hydro-carbon liquid; in allowing the same to settle, and removing therefrom the floating layer of said solution and the mineral particles which have been coated thereby; and in filtering the material so removed, substantially as specified.

5. [11.]* The process of separating minerals, which consists in mixing together the pulverized mineral material, a considerable quantity of water, and a solution of bitumen in a light hydro-carbon liquid ∧; in gently agitating this mixture and blowing gas into the

Insert A, Mar. 24/05.>

same to assist the flotation of said solution and the mineral particles which have been coated thereby; in removing said floating layer; and filtering the same, substantially as specified.

6. [12.]* The process of separating minerals which consists in mixing together the pulverized mineral material, a considerable quantity of water, and a solution of bitumen in a distillable hydro-carbon liquid ∧; in allowing the same to settle, and removing there-

1949 Insert A, Mar. 24/05.>

from the floating layer of said solution and the mineral particles which have been coated thereby; in filtering the material so

concentrate residue

Mar. 24/05. removed; and in distilling the ∧ [filtrate]* and condensing the hydro-carbon vapors driven off, substantially as specified.

7. [13.]* The process of separating minerals, which consists in mixing together the pulverized mineral material, a considerable quantity of water, and a solution of bitumen in a distillable hydro-carbon liquid; in gently agitating this mixture and blowing gas into the same to assist in the flotation of said solution and the mineral particles which have been coated thereby; in removing the floating layer, and filtering the same; and in distilling the

concentrate residue

Mar. 24/05. ∧ [filtrate]* and condensing the hydro-carbon vapors driven off, substantially as specified.

8. [14.]* The process of separating minerals, which consists in mixing together the pulverized mineral material, a considerable quantity of water, and a solution of bitumen and kerosene; in gently agitating this mixture, and in blowing a gas into the same to assist in the flotation of said solution and the mineral particles which have been coated thereby; and in separating said solution and mineral particles, substantially as specified.

9. [15.]* The process of separating minerals, which consists in mixing together the pulverized mineral material, a considerable quantity of water, and a solution of bitumen in kerosene, and in vigorously agitating this mixture so as to break up said solu-

[*Words and figures enclosed in brackets erased in copy.]

1950 tion into minute globules; in gently agitating said mixture and blowing a gas into the same to assist in the flotation of said solution and the mineral particles coated thereby; in removing the floating layer; in washing and filtering the same; and finally in concentrate residue

Mar. 24/05. distilling the ^ [filtrate]* and condensing the hydro-carbon vapors driven off, substantially as specified.

In testimony whereof, I hereunto affix my signature in the presence of two witnesses.

EDMUND B. KIRBY.

Witnesses:

T. L. SAVAGE.
E. G. EASTMAN.

STATE OF WASHINGTON,
County of Stevens, ss:

Edmund B. Kirby, the above named petitioner, being duly sworn, deposes and says that he is a citizen of the United States, and a resident of Rossland in the Province of British Columbia and Dominion of Canada, and that he verily believes himself to be the original, first and sole inventor of the improvement in process of separating minerals described and claimed in the annexed specification; that he does not know and does not believe that the same was ever known or used before his invention or discovery thereof; or patented or described in any printed publication in the United States of America or any foreign country before his invention or discovery thereof or more than two years prior to this application; or in public use or on sale in the United States for more than two years prior to this application and that no application for foreign patent on said
1951 invention has been filed by him or his legal representatives or assigns, in any foreign country.

EDMUND B. KIRBY.

Sworn to and subscribed before me, this 4th day of December 1903.

[SEAL.] JOHN A. KELLOGG,
Notary Public.

Notary Public for State of Washington, residing at Northport, Washington.

[*Words and figures enclosed in brackets erased in copy.]

2–260.

M. E. C.

Div. —, Room No. 315.

Address only "The Commissioner of Patents, Washington, D. C."

Paper No. 1.

All communications respecting this application should give the serial number, date of filing, and title of invention.

Department of the Interior,

United States Patent Office,

Washington, D. C., January 19, 1904.
Mailed " " "

Edmund B. Kirby, care Thurston & Bates, Cleveland, Ohio:

Please find below a communication from the Examiner in
1952 charge of your application, #185,033, filed December 14, 1903, for Process of Separating Minerals.

F. I. ALLEN,
Commissioner of Patents.

50 should be inserted in the drawing. "Raidally," page 8, line 27, should be corrected. It is suggested that "curved" would be more appropriate than "spiral," line 1, page 9. The submergence of the side of the box 29 is required to be illustrated.

Claim 1 fails to express anything patentable over 676,679, Elmore, June 18, 1901, Washers, H, the only distinction being as to the manner of recovering the oil by distillation. The final portion in Elmore appears to be considered too unimportant to warrant special treatment. The question appears to be a purely commercial one, not one calling for invention. See als- 521,899, Sutton, June 26, 1894, Metallurgy, Solution and Precipitation, Chlorination.

Claim 2 is rejected in view of Elmore, Sutton, cited, and British patent 12,778, Lake, June 4, 1902, Washers.

Claim 3 is rejected in view of Elmore and Lake, cited.

Claim 4 is rejected in view of Elmore, Lake and 736,381, Glogner, Aug. 18, 1903, Washers, H.

Claim 5 is rejected upon the reference for claim 4, as is also claim 6.

Claim 7 is rejected in view of the references for claim 4, the distilling step being held to be one which would naturally suggest itself to anyone desiring to recover substantially all the oil.

1953 Claim 8 is rejected in view of Elmore, Glogner and Lake. The use of an oil intermediate in composition between that of Elmore and that of Glogner does not appear to call for more than judgment or selection.

Claim 9 is rejected as lacking invention in view of Elmore and Lake.

Claim 10 is rejected in view of the references for claim 8.

Claim 11 is rejected in view of the references for claim 8, as are also claims 12, 13, 14, 15, the distillation of the oil being considered not to involve invention as has been stated above.

LEWIS B. WYNNE,
Examiner, Division XXV.

T. F. MITCHELL.

Mail Room,
Mar. 21, 1904,
U. S. Patent Office.

Patent Office,
Mar. 22, 1904,
Division XXV.

Serial No. 185,033, Paper No. 2.

Room No. 315.

Cleveland, Ohio, March 16, 1904.

Commissioner of Patents, Washington, D. C.

DEAR SIR: In the matter of the application of Edmund B. Kirby for Process of Separating Minerals, filed December 14, 1903, Serial No. 185,033, last Office action January 19, 1904.

1954 After carefully considering the references cited, we find ourselves unable to agree with the examiner's conclusion as to their bearing on the patentability of the process set forth by the various claims; and we here submit our reasons for believing that the claims are patentable over the citations.

The Elmore patent describes a process in which a thick oil is to be used,—said oil being the non-distillable residuum of petroleum distillation. The Elmore process is in practical use in various parts of the world, but this thick residuum oil is always used, care being taken not to break it up into globules, but to maintain it in large clots, as set forth in the patent. The Elmore patent does not specify in what manner the ore is separated from the oil to which it adheres, but, as a matter of fact, the method employed by Elmore in practice is to employ a centrifugal separating machine, which removes a very large percentage of oil, but nevertheless does not remove it all. There is, therefore, a considerable loss of oil. Elmore does not filter the oil-covered concentrate, because the oil will not pass through a filter; and he does not distill it because it will not distill. One may not infer, therefore, from Elmore's silence as to his method of recovering the oil, that he may have used filteration and distillation, of that it was merely a matter of selection with him whether or not he should use these methods. We, of course, understand that filtration to separate a liquid from a solid is not a process which applicant originated. The recovery of oil by distillation is likewise old,

1955 and certainly no claim pretends to cover either of these processes per se. Applicant, however, is the first ever to have

devised a practical process for concentrating ore by means of some substance immiscible in water having preference of adhesion for the mineral particles, and in which, because of the character of immiscible substance so used, it could be recovered in its entirety without any loss, except the loss of the small quantity of bitumen employed, by using the processes of filtration and distillation. We should think there could be no question as to the patentability of those claims in applicant's case, which not only specify filtration and distillation, but which also specify a thin hydro-carbon or kerosene or the kerosene-bitumen solution. It would seem also that such claims, as claim 1, which are not limited to the specific filterable and distillable oil, are likewise allowable, because, as above stated, applicant was the first to devise a practical commercial process in which filtration and distillation could be, and was, used as the method for recovering the concentrating material.

The British patent, mentioned, seems to be for a laboratory experiment; but passing that question, we submit that it is not a sufficient reference for the rejection of any of applicant's claims. The process consists in mixing with the oil some limestone, some water "a thin layer of ordinary oil" and some sulphuric acid. This latter, by getting upon the limestone, generates a gas, and, as a result, the chalcopyrite will instantly rise to the top of the liquid. This
1956 process is only intended for the treatment of sulphides. The foregoing is the process as described. The scientific knowledge, upon which the process is based, includes, so the patent stated, the knowledge that if a gas of any kind is *liberated* in this mass the bubbles become covered with a coating of sulphide.

Applicant's is a practical industrial process, not a theory or laboratory experiment. It does not involve the mixture of ore and some material from which a gas may be generated, but it does include the exceedingly practical act of blowing air or some gas, obtained externally of the charge, into the mixture of ore and water and the hydro-carbon solution. Its claims are limited to blowing in the air,—as a result of which the bubbles of air attach themselves like balloons to oil-coated particles and float them to the surface. Applicant's claims *exclude* the flotation of the oil-covered concentrates by *generating* a gas within the charge.

The Sutton patent describes the use of kerosene as a collector of precipitated gold,—gold precipitated from its chlorine solution. What is meant by a collector of precipitated gold is not understood, but the precipitate is in such a finely subdivided condition that possibly kerosene or turpentine might cause it to be collected and floated. It is not pretended, however, by the patentee that the use of kerosene alone would have any substantial or practical effect upon anything else except precipitated gold. This Sutton patent cer-
tainly is not an anticipation of any claim in the pending ap-
1957 plication, and can be regarded only as indicating so much as it describes, namely, that the thin hydro-carbon will collect precipitated gold, if introduced into the gold solution before the precipitating sulphate of iron has been added.

The glogner patent uses petroleum for the purpose of collecting

graphite from earthy admixtures therewith. The patent states that it is not useful, unless one first washes out everything except the graphite and the earthy material. Then the petroleum, which the patent directs to be used, is we presume, natural oil which is not a thin oil and contains not only distillable portions, but the non-distillable residuum which Elmore uses. This patent certainly gives no information, by which one could be led to applicant's commercial process of separating the mineral from the non-mineral constituents of crushed ore; and furthermore the patent distinctly states that the process can only be used to collect graphite from a certain admixture therewith.

We presume the examiner is aware of the present activity in various parts of the world of mining engineers and chemists in the matter relating to ore concentration by using oil in different ways. That these skilled men, eagerly and intelligently working in this field, have not found anything in the patents cited to direct them to applicant's process is, we think, a strong argument supporting our view that they do not anticipate applicant's claim. The process described in
1958 applicant's process is a practicable, workable and successful process,—a statement which cannot be made of any of the processes described in the patents cited in so far as they relate to the separation of the mineral and the non-mineral parts of crushed ore. The examiner must admit that not one of applicant's claims is met by any one of the citations. In this art, particularly it would seem as if the non-patentability of claims should not be predicated upon two or three or more patents, one of which anticipated the claims, upon the theory that one patent shows one of the steps while another shows another of the steps which, in combination, are the subject of applicant's claims.

We request a reconsideration in view of the foregoing and a favorable action.

Respectfully,

THURSTON & BATES,
Attys. for Edmund B. Kirby.

1959 2–260.

M. E. C.

Div. 25, Room 315.

Address only "The Commissioner of Patents, Washington, D. C."

Paper No. 3.

All communications respecting this application should give the serial number, date of filing, and title of invention.

Department of the Interior,

United States Patent Office,

Washington, D. C., April 23, 1904.
Mailed " " "

Edmund B. Kirby, care Thurston & Bates, Cleveland, Ohio:

Please find below a communication from the Examiner in charge of your application, #185,033, filed December 14, 1903, for Process of Separating Minerals.

F. I. ALLEN,
Commissioner of Patents.

Case as argued March 21, 1904, further considered.

The 1st claim is rejected in view of Glogner, (taken in connection with the process described on page 344, Vol. XI, Mineral Industry, a copy of which is in the Scientific Library of the U. S. Patent Office. This description refers to *petroleum* vapor which certainly is volatile,) and Elmore. Elmore discloses filter pressing, while distillation for the recovery of the last traces of oil is not disclosed, it is insisted that it is not a matter of invention in view of the common practice of extracting oil from substances containing them by distillation, and the general practice of distilling amalagam, after straining, for the recovery of the mercury, amalgamation being a very analogous process to oil-separating processes. 1960

It being an old practice to blow gas into pulp to separate material by flotation (see e. g., 469,599, Rouse, Feb. 23, 1892, Washers, A) and the use of gas to aid in the flotation of oil coated particles also being old (Lake of record) it would not appear to involve invention to employ air in the process of e. g., 725,609, Wolfe, Apr. 14, 1903, Washers, H. The 2nd claim is therefore rejected.

Claim 3 is more specific, and, on reconsideration, will be allowed.

Claim 4 is rejected upon the references for the 2nd claim and the reference to Mineral Industry, cited, showing the use of petroleum vapor, which is a thin oil.

The 5th, 6th and 7th claims are rejected upon the references for the first two claims, as expressing mere selections of steps from the prior art without change of relation.

The 8th claim is too indefinite in view of the references for claim 2. The objection lies in the fact that the claim does not specify the relative proportion of oil and bitumen, and the term "solution of bitumen in a light hydrocarbon liquid" may be said to apply to *petroleum*, if the construction contended for by applicant is to be applied to "petroleum." 1961

The same applies to the 9th claim. But it may be said that if applicant specifies the proportions of hydro-carbon liquid and petroleum, the examiner is inclined to favorably consider these two claims.

Claim 10 is rejected as destitute of invention in view of Glogner and Elmore, cited.

What has been said of the 8th and 9th claims applies also to the 11th and 12th.

The 13th, 14th and 15th claims will be allowed.

Applicant would seem to intend that the term "filtrate" apply to the concentrates and their retained oil. If so, the use of the term is incorrect, the term "filtrate" meaning the solution or material passing *through* the filter.

LEWIS B. WYNNE,
Examiner, Division XXV.

T. F. MITCHELL.

1962 Mail Room,
Mar. 24, 1905,
U. S. Patent Office.

Patent Office,
Mar. 25, 1905,
Division XXV.

Serial No. 185,033, Paper No. 4.

Room No. 315.

Cleveland, Ohio, March 18, 1905.

Commissioner of Patents, Washington, D. C.

DEAR SIR: In the matter of the application of Edmund B. Kirby for Process of Separating Minerals, filed December 14, 1903, Serial No. 185,033, last Office action April 23, 1904:

Amendment is made as follows:

1. On page 8, line 27 change "raidally" to *radially*.
2. Page 9, line 1, change "spiral" to read *curved*.
3. Page 10, line 13, change "lever" to read *level*.
4. In claim 1, line 9, claim 7, line 9, claim 12 line 7, claim 13 line 8 and claim 15 line 9, change "filtrate" to read *concentrate residue*.
5. Claim 8, line 4, claim 9 line 4, claim 11 line 4, and claim 12 line 4, after the word "liquid," in each instance, insert

A. *the proportion of bitumen in solution being substantially sufficient to insure the coating and entrainment of the mineral particles.*

Respectfully,

E. B. KIRBY,
By THURSTON & BATES,
His Attorneys.

1963 *Remarks.*

In connection with the rejection of claim 1, the Examiner's reconsideration of the citation from the Minerals Industry is asked. This article, while possibly being of interest to those engaged in the graphite industry, does not appear to offer the slightest suggestion of value to those who are endeavoring to recover metallic minerals

from the gangue. The article referred to, while disclosing the use of a distillable oil, in a particular connection, does not in the slightest manner indicate to any one that it would be possible to make use of a light distillable oil in selecting out metallic values from a pulverized ore. It would be impossible to substitute this step of saturating graphite flakes with petroleum vapor in a mineral separating process, even should it by chance occur to any one to try it. There surely can be nothing in the discovery of the fact that graphite flakes can be saturated with a vapor of petroleum which would lead one to think that kerosene could be used in a mineral separating process where hitherto thick viscid bitumen alone had been employed. There is no step in Glogner's process which could be substituted by any step in the process described in the Mineral Industry and result in the applicant's process. It seems plain to the applicant that claim 1 should be allowed.

With regard to claim 2 attention is called to the fact that Rouse does not use air for the purpose of assisting in gently agitating and effectually separating those particles which naturally would float to the surface from those which would naturally sink. Rouse violently drives the fine particles to the surface by sheer force of his air blast, and it is necessary that they should be immediately skimmed off, since they will only float so long as the foam lasts. He, as a matter of fact, has of necessity to create a disturbance in the body of the liquid which would be harmful and detrimental in the applicant's procedure. Lake's process is for a specifically different thing and does not tell the public anything about the advantage of gently agitating a mixture of water and mineral particles coated with an immiscible liquid and assisting their separation by blowing in air. Lake discovered that gas bubbles, liberated in the manner which he describes, become coated with chalco-pyrite dust. This discovery is absolutely without value in the applicant's process since the mineral particles are already coated with bitumen, and the *public* presented is one of separating the bitumen from the water. In connection with the rejection of claim 4 it must be insisted that the article in the Mineral Industry has not contributed anything which is of any assistance in this process.

1964

Claims 5, 6 and 7 have been rejected on the general ground of lack of invention in view of the state of the art. As the applicant understands this theory of rejection, it requires that when the references cited are spread before one the applicant's process shall thereupon become obvious. Now it is submitted that there is no suggestion of the applicant's sequence of steps in the prior art. He is assuredly the first to use the process claimed, and finds that it is a distinct step forward, productive of results hitherto not attained, and it seems that it would be a practical denial of his legal rights to refuse him protection on that which is his and his alone. This process is surely not an obvious one; otherwise, being successful, as it is, it would have been previously practiced.

1965

The art to which it relates is one in which experimentation is at once difficult and expensive, and it would seem that whenever an inventor has sufficient confidence in the merits of a new procedure,

which he has conceived, to go to the risk and expense necessary to determine the operativeness of the same that the somewhat theoretical question of invention should be decided in his favor.

Claims 8, 9, 11 and 12 have been amended as desired.

Claim 10 it is thought should be allowed on the grounds set forth above. It is understood that the remaining claims are regarded as allowable.

Respectfully,

THURSTON & BATES.

1966 M. E. C.

2–260.

Div. 25, Room 315.

Address only "The Commissioner of Patents, Washington, D. C."

Paper No. 5.

All communications respecting this application should give the serial number, date of filing, and title of invention.

Department of the Interior.

United States Patent Office,

Washington, D. C., May 2, 1905.

Edmund B. Kirby, care Thurston and Bates, Cleveland, Ohio:

Please find below a communication from the Examiner in charge of your application, #185,033, filed December 14, 1903, for Process of Separating Minerals.

F. I. ALLEN,
Commissioner of Patents.

Case as amended and argued March 24, 1905, further considered.

Wolfe of record amply discloses the use of kerosene for recovering gold; this taken in connection with Glogner and the reference to Mineral Industry of record amply anticipate the use of a light volatile oil for the recovery of metals. The 1st claim is rejected in view of Wolfe, Elmore of record, and the analogous process
1967 of amalgamation in which mercury is the selective material.

In the amalgamation of gold it is the universal practice to strain the amalgam, and subject the residue to distillation to recover the last of the mercury. It would not involve invention to follow the strictly analogous series of steps with oil. See 207,695, Tunbridge, Sept. 3, 1878, (page 2, lines 11-13, 1st column.)

British patent to Lake discloses the use of oil and gas in separating ores. In view of this, it would not involve invention to inject air in Wolfe, in view of Rouse of record, or 751,645, Hopkins, Feb. 9, 1904, Washers, A. The 2nd claim is therefore rejected.

The 4th is rejected upon the references for claim 2.

The 5th, 6th and 7th claims are rejected in view of the references for the first two claims.

The other claims will probably be allowed.

LEWIS B. WYNNE,
Examiner, Division XXV.

T. F. MITCHELL.

1968 Mail Room,
Jun- 26, 1905,
U. S. Patent Office.

Patent Office,
Jun- 27, 1905,
Division XXV.

Serial No. 185,033, Paper No. 6.

Room No. 315.

Cleveland, Ohio, June 24, 1905.

Commissioner of Patents, Washington, D. C.

DEAR SIR: In the matter of the application of Edmund B. Kirby for Process of Separating Minerals, filed December 14th, 1903, Serial No. 185,033, last Office action May 2, 1905.

Amendment is made as follows:

Cancel claims 1, 2, 4, 5, 6 and 7.

E. B. KIRBY,
By THURSTON & BATES, *Attys.*

1969 2–181.

A. R.

Serial No. 185,033.

Issue Division.

All communications should be addressed to "The Commissioner of Patents, Washington, D. C."

Department of the Interior,

U. S. Patent Office,

Washington, D. C., July 10, 1905.

Edmund B. Kirby, c/o Thurston & Bates, S. F. S. Bldg., Cleveland, Ohio.

SIR: Your application for a patent for an improvement in Process of Separating Minerals. Filed Dec. 14, 1903, has been examined and allowed.

The final fee, twenty dollars, must be paid, and the Letters Patent bear date as of a day not later than six months from the time of this present notice of allowance.

If the final fee is not paid within that period the patent will be withheld, and your only relief will be by a renewal of the application, with additional fees, under the provisions of Section 4897, Revised Statutes. The Office aims to deliver patents upon the day of their date, and on which their term begins to run; but to do this properly applicants will be expected to pay their final fees at least twenty days prior to the conclusion of the six months allowed them by law. The printing, photolithographing, and engrossing of the several patent parts, preparatory to final signing and sealing, will consume
1970 the intervening time, and such work will not be done until after payment of the necessary fees.

When you send the final fee you will also send, distinctly and plainly written, the name of the inventor and title of invention as above given, date of allowance (which is the date of this circular), date of filing, and, if assigned, the names of the assignees.

If you desire to have the patent issue to assignees, an assignment containing a request to that effect, together with the fee for recording the same, must be filed in this Office on or before the date of payment of final fee.

After issue of the patent uncertified copies of the drawings and specifications may be purchased at the price of 5 cents each. The money should accompany the order. Postage stamps will not be received.

Respectfully, F. I. ALLEN,
Commissioner of Patents.

After allowance, and prior to payment of the final fee, applicants should carefully scrutinize the description to see that their statements and language are correct, as mistakes not incurred through the fault of the office, and not affording legal grounds for reissues, will not be corrected after the delivery of the letters patent to the patentee or his agent.

In remitting the final fee give the Serial Number at the head of this notice.

If payment is made by check or draft, the credit allowed is subject to the collection of the same.

1971 $20, ck., Received Dec. 23, 1905. Z. Chief Clerk, U. S. Patent Office.

Cleveland, Ohio, Dec. 21, 1905.

Commissioner of Patents, Washington, D. C.

DEAR SIR: In the matter of the application of Edmund B. Kirby, for an improvement in Process of Separating Minerals, filed December 14, 1903, Serial No. 185,033, allowed July 10, 1905, we hand you herewith as final Government Fee $20.00 in the form of our check.

Yours truly,
From THURSTON, BATES & WOODWARD,
1029 *Society for Savings Building,*
Cleveland, Ohio.

1972

2–183.

S. M.

Serial No. 185,033.

Issue and Gazette Division.

All communications should be addressed to "The Commissioner of Patents, Washington, D. C."

Department of the Interior,

United States Patent Office,

Washington, D. C., Dec. 23, 1905.

Edmund B. Kirby, c/o Thurston, Bates & Woodward, 1028 Society for Savings Bldg., Cleveland, Ohio.

SIR: Your application for a patent for an improvement in Process of Separating Minerals, filed Dec. 14, 1903, has been examined and again allowed.

The final fee, twenty dollars, in the above-entitled case was received Dec. 23, 1905.

Very respectfully,

F. I. ALLEN,
Commissioner of Patents.

[Here follows printed copy of Patent 809,959.]

1973 1903.

Contents.

83. Mills,
Ore and Coal Washers.

Print, —— —, ——.
Application, — papers, O. K.
1. Rej., Jan. 19, 1904.
2. Argument, Mar. 21, 1904.
3. Rej., Apr. 23, 1904.
4. Amendment A, Mar. 24, 1905.
5. Rej., May 2, 1905.
6. Amendment, June 26, 1905.
7.
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23.

Title: Improvement in Process of Separating Minerals.

1974 DEFENDANT'S EXHIBIT.

Certified Copy of File-wrapper and Contents of Patent in Suit No. 835,120.

United States of America,

Department of the Interior,

United States Patent Office.

To all to whom these presents shall come, Greeting:

This is to certify that the annexed is a true copy from the Records of this office of the File Wrapper and Contents, in the matter of the Letters Patent of Henry Livingstone Sulman, Hugh Fitzalis Kirk-

patrick-Picard, and John Ballot, Number 835,120, Granted November 6, 1906, for Improvement in Ore Concentration.

In testimony whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed at the City of Washington, this 5th day of December, in the year of our Lord one thousand nine hundred and eleven and of the Independence of the United States of America the one hundred and thirty-sixth.

[SEAL.]

F. A. TENANT,
Assistant Commissioner of Patents.

1975

2–437.

Number (Series of 1900).
262,889.

1905.

Divn. XXV.

Div. 25.
(Exr.'s Book) 4-13.

Patent No. 835,120.
Name: Henry Livingstone Sulman, Hugh Fitzalis Kirkpatrick-Picard and John Ballot,
Of London,
County of ——, England.
Invention: Ore Concentrators.

		Original.	Renewed.
Parts of application filed.	Petition,	May 29, 1905,	— —, 190-.
	Affidavit,	" " 1905,	—— —, 190-.
	Specification,	" " 1905,	—— —, 190-.
	Drawing,	" " 1905,	—— —, 190-.
	Addl. "	Apr. 17, 1906,	—— —, 190-.
	Model or Specimen not reqd.,	—— —, 190–,	—— —, 190-.
	First Fee, Cash $15,	May 29, 1905,	—— —, 190-.
	1. " " Cert.,	—— —, 190–,	—— —, 190-.
	Appl. filed complete,	May 29, 1905,	—— —, 190-.
Examined, Lewis B. Wynne,		July 2, 1906,	—— —, 190-.
Countersigned, W. W. Mortimer,			—— —, 190-.
		For Commissioner.	For Commissioner.
Notice of Allowance,		July 6, 1906,	—— —, 190-.
Final Fee, Cash $20,		Oct. 15, 1906,	—— —, 190-.
2. " " Cert.,		—— —, 190–,	—— —, 190-.

Patented, November 6, 1906.
Associate Attorney, —— ——.

Attorney-, Knight Bros.,
McGill Buildg., City.
Serial Number, ——.
Date of Patent, ——.

Name, —— ——,
3. Patent No. —.

[On left margin:] Division of App. No. —, filed —— —, 190-.

1976 *Joint Petition.*

$15 Received May 29, 1905. J. Chief Clerk, U. S. Patent Office.

Serial No. 262,889, Paper No. —.

Application.

To the Commissioner of Patents:

Your Petitioners Henry Livingstone Sulman, Hugh Fitzalis and Kirkpatrick-Picard and John Ballot, subjects of the King of England, and residents of London, England, whose Post Office addresses are respectively 44, London Wall, London, E. C., 44 London Wall, London, E. C., and 62, London Wall, London, E. C. pray that Letters Patent may be granted to them, as joint inventors, for the improvements in "Ore Concentration," set forth in the annexed Specification, and they hereby appoint Messrs. Knight Bros., McGill Bldg., Washington, D. C. a firm consisting of Hervey S. Knight and Harry A. Knight their Attorneys with full power of substitution and revocation, to prosecute this application, to make alterations and amendments therein to receive the Patent, and to transact all business in the Patent Office connected therewith.

Signed at London, England, this 17th day of May, 1905.
Inventors:

HENRY LIVINGSTONE SULMAN.
HUGH FITZALIS KIRKPATRICK-PICARD.
JOHN BALLOT.

1977 To all whom it may concern:

Be it known that we, Henry Livingstone Sulman, Hugh Fitzalis Kirkpatrick-Picard and John Ballot, all subjects of the King of England, and residing in London, England, have invented certain new and useful improvements in ore concentration of which the following is a specification:—

This invention relates to improvements in the concentration of ores, the object being to separate metalliferous matter, graphite and the like from gangue, by means of oils, fatty acids or other substances which have a preferential affinity for metalliferous matter over gangue.

In the process described in the previous United States Patent No. 777,273, granted to A. E. Cattermole, an amount of oil varying from 4% to 6% of the weight of metalliferous matter present is agitated with an ore pulp so as to form granules which can be separated from the gangue. In the previous United States Patent No 777,274, granted to A. E. Cattermole and others, a similar method of separation is employed, oleic acid being produced in situ in the ore pulp.

We have found that if the proportion of oily substance be con-

siderably reduced, say to a fraction of 1% on the ore, granulation ceases to take place and after vigorous agitation, there is a tendency for a part of the oil-coated metalliferous matter to rise to the surface of the pulp in the form of a froth or scum.

This tendency is dependent on a number of factors. Thus, the water in which the oiling is effected is preferably slightly
1978 acidified by adding say a fraction of 1% up to 1%, of sulphuric acid or other mineral acid or acid salt, the effect of this acidity being to prevent gangue from being coated with oily substance, or in other words, to render the selective action of the oil more marked; but it is to be understood that the object of using acid in the pulp according to this invention is not to bring about the generation of gas for the purpose of flotation thereby, and the proportion of acid used is insufficient to cause chemical action on the metalliferous minerals present.

Again, we have discovered that the tendency for the oily substance to disseminate through the pulp and the rapidity with which the metalliferous matter becomes coated is increased if the pulp is warmed.

The formation of froth is assisted by the fine pulverization of the ore and we find that slime mineral most readily generates scum and rises to the surface while larger particles have less tendency to be included in the froth.

The proportion of mineral which floats in the form of froth varies considerably with different ores and with different oily substances, and before utilising the facts above mentioned in the concentration of any particular ore a simple preliminary test is necessary to determine which oily substance yields the proportion of froth or scum desired.

The following is an example of the application of this invention to the concentration of a particular ore.

An ore containing ferruginous blende, galena, and gangue
1979 consisting of quartz, rhodonite, and garnet, is finely powdered and mixed with water containing a fraction of 1% or up to 1% of a mineral acid or acid salt, conveniently sulphuric acid, or mine or other waters containing ferric sulphate. To this is added a very small proportion of oleic acid (say, from 0.02% to 0.5% on the weight of ore), the mixture is warmed say to 30° to 40° C. and is briskly agitated in a cone mixer or the like, as in the processes previously cited, for about 2½ to 10 minutes, until the oleic acid has been brought into efficient contact with all the mineral particles in the pulp.

When agitation is stopped a large proportion of the mineral present rises to the surface in the form of a froth or scum which has derived its power of flotation mainly from the inclusion of air bubbles introduced into the mass by the agitation, such bubbles or air films adhering only to the mineral particles which are coated with oleic acid. The minimum amount of oleic acid which can be used to effect the flotation of the mineral in the form of froth may be under 0.1% of the ore, but this proportion has been found suitable and economical.

If the ore were crushed to 90 mesh to the linear inch (half of which ore will pass through 150 mesh sieve) the froth may contain about 70% to 80% of the metalliferous matter present in the ore. This froth is removed from the pulp by spitzkast, upcast, skimming, draining, or otherwise; after subsidence the oil-coated metalliferous matter removed as froth is separated from any liquid which
1980 may have accompanied it and treated with a dilute solution of caustic alkali which removes the oleic acid in the form of a solution of soap.

If desired, the oleic acid used in the first instance may be produced in situ in the pulp by decomposing a dilute soap solution with mineral acid as described in the previous Patent No. 777,274, cited above. The oleic acid or other fatty acid forming the coating on the metalliferous matter which produces the froth, may give rise to insoluble soaps on the surface of the metalliferous matter if soluble lime, iron or other salts are present in small quantity during the production, or on the breaking down of the froth with alkali; such insoluble soaps are difficult to remove and are capable of adhering to air and causing flotation much the same as the fatty acids do.

The metalliferous matter which did not form part of the froth (generally the larger particles) remains in admixture with the gangue in the pulp. To recover this, the pulp is distributed in a thin layer on a shaking table, convex buddle or the like, whereon the mineral is exposed to a free air surface, which exposure may be increased by the application of air blast or air jets or the like, and thereafter brought on to the edge or surface of liquid whereby the metalliferous matter floats and is separated from the gangue which sinks as described in the Specification of our previous United States Applica-
filed February 20, 1905.
Nov. 20/05. tion No. 246,637,

The proportion of mineral recovered in the froth and that recovered by table flotation may be considerably
1981 varied but generally speaking the froth will separate the slime mineral while the larger particles are recovered by the latter method.

Sub. A, Apr. 17/06.

The accompanying drawing is a diagram of one form of apparatus suitable for carrying this invention into practice.

[Matter enclosed between rules erased in copy.]

Referring to Fig. 1 a mixing

Apr. 17/06. [A mixing]* A vessel A (of which there may be any number in series) is provided with a rotatable stirrer B. Crushed ore is fed from a hopper C into the vessel by a band D. A pipe E controlled by a tap E^1 delivers circuit water to the vessel, and oleic acid or other oil is introduced through pipe F and tap F^1. The other cock G from the vessel A communicates through a swan-neck pipe H with the froth separating apparatus.

[*Words and figures enclosed in brackets erased in copy.]

In passing from the frothing apparatus A to the spitzkasten (say between O and K) the pulp may if desired be run in a thin layer over a smooth slightly inclined plane

Canceled Apr. 24/06. Nov. 20/05, canceled.

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and may be submitted to the action of a series of air jets in order to increase the amount of floating metalliferous matter to a maximum. [as illustrated in our previous application above referred to.]*

Apr. 17/06, canceled.

[Matter enclosed between rules erased in copy.]

The froth separating apparatus comprises several (say three) pointed boxes J^1, J^2, J^3 which open at the top into a horizontal channel consisting of side walls K. The channel has a narrow inlet K^1 and spreads out to a wide outlet K^2. The pointed boxes J^1, J^2, J^3 have full-way cocks L^1, L^2, L^3, at the bottom leading to swan-neck discharge pipes M^1, M^2, M^3. An up-current of water may
1982 be led in at the bottom of each through a tap N^1, N^2, N^3.

The boxes are all filled with circuit water; the pulp from the vessel A is distributed horizontally from the flat trough O through the inlet K^1. The heavy sands and coarser particles of mineral sink into the first box J^1 from which they are led to a shaking table, convex buddle, or the like to be treated as above described. The middlings or medium sands fall into the box J^2 and if they contain any mineral, may be removed for further treatment by agitation. The up-current of water from the taps N^1 N^2 prevents the deposition of any slime in these boxes. The fine sands or gangue slimes settle in the last box J^3 from which they are discharged to waste or further treatment.

The slime mineral in the form of froth or scum floats from the liquid and is carried by the stream over the outlet K^2 into a launder P and thence to a filter Q where the metalliferous matter is removed from the circuit water which is returned to the vessel A by a pump R. The circuit water may be brought to the proper temperaturre by passing it through a heater S having a burner S^1 before admitting the water to the vessel A.

An alternative method for the recovery of any sunk oiled metalliferous matter which may be deposited in the second and third spitzkasten is as follows: The products suspended in circuit liquor are removed from the spitzkasten and placed in a vessel in which they
are submitted to an additional pressure of air or other gas of
1983 from, say, 1 to 2 atmospheres, or over. On relief of such pressure the bubbles of air, or other gas so generated throughout the mass at once sweep to the surface thereof all the metalliferous matter in the form of a froth which can be separated as before. ^

Insert A^1, Apr. 17/06.>
Insert A^2, Apr. 17/06.>

[*Words and figures enclosed in brackets erased in copy.]

The nature and arrangement of the apparatus used may be varied without departing from this invention.

What we claim as our invention and desire to secure by Letters Patent is:

1. The herein described process of concentrating ores which consists in mixing the powdered ore with water, adding a small proportion of an oily liquid having a preferential affinity for metalliferous matter, (amounting to a fraction of 1% on the ore), agitating the mixture until the oil-coated mineral matter forms into a froth, and separating the froth from the remainder by flotation.

2. The herein described process of concentrating ores which consists in mixing the powdered ore with slightly acidified water, adding a small proportion of an oily liquid having a preferential affinity for metalliferous matter (amounting to a fraction of 1% on the ore), agitating the mixture until the oil-coated mineral matter forms into a froth and separating the froth from the remainder by flotation.

3. The herein described process of concentrating ores which consists in mixing the powdered ore with slightly acidified water, adding a small proportion of an oily liquid having a preferential affinity for metalliferous matter (amounting to a fraction of 1% on
1984 the ore), warming the mixture, agitating the mixture until the oil-coated mineral matter forms into a froth and separating the froth from the remainder by flotation.

4. The herein described process of concentrating ores which consists in finely powdering the ore, mixing it with slightly acidified water, adding a small proportion of an oily substance having a preferential affinity for metalliferous matter (amounting to a fraction of 1% on the ore), warming the mixture, agitating the mixture until the oil-coated mineral matter forms into a froth, separating the froth from the remainder by flotation, and removing the oily coating from the mineral.

5. The herein described process of concentrating ores which consists in mixing the powdered ore with water, adding a small proportion of oleic acid amounting to 0.02–0.5% on the ore, agitating the mixture until the oleic acid has been brought into efficient contact with the mineral and has formed a froth therewith, and separating the froth from the remainder by flotation.

6. The herein described process of concentrating ores which consists in mixing the powdered ore with water containing
a fraction of
Apr. 17/06. A [less than]* 1% of sulphuric acid, adding a small proportion of oleic acid amounting to 0.02–0.5% on the ore, agitating the mixture until the oleic acid has been brought into efficient contact with the mineral and has formed a froth therewith, and separating the froth from the remainder by flotation.

7. The herein described process of concentrating ores which
1985 consists in mixing the powdered ore with water containing
a fraction of
Apr. 17/06. A [less than]* 1% of sulphuric acid, adding a

[*Words and figures enclosed in brackets erased in copy.]

small proportion of oleic acid amounting to 0.02–0.5% on the ore, warming the mixture to 30°–40° C., agitating the mixture until the oleic acid has been brought into efficient contact with the mineral and has formed a froth therewith, and separating the froth from the remainder by flotation.

8. The herein described process of concentrating ores which consists in finely powdering the ore, mixing it with water containing a fraction of [less than]* 1% of sulphuric acid, adding sufficient oleic soap solution to produce oleic acid amounting to 0.02–0.5% on the ore, warming the mixture to 30°–40° C., agitating the mixture until the oleic acid has been brought into efficient contact with the mineral and has formed a froth therewith, separating the froth from the remainder by flotation, filtering off the froth and removing the oleic acid therefrom by treatment with an alkali.

" " "

Insert A², Apr. 17/06.

Canceled Apr. 17/06.

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9. The herein described process of concentrating ores which consists in finely powdering the ore, mixing it with water containing less than 1% of sulphuric acid, adding sufficient oleic soap solution to produce oleic acid amounting to 0.02–0.5% o nthe ore, warming the mixture to 30°–40° C., agitating the mixture until the oleic acid has been brought into efficient contact with the mineral and has formed a froth with the finer mineral, distributing the mixture on the surface of a current of water running over columns of water, so that the coarser minerals and sands, the finer sands and the
1986 gangue slimes successively deposit out while the froth is floated away by the current, filtering off the froth and removing the oleic acid therefrom by treatment with an alkali and separating the coarser mineral from the sands by exposing them alternately to air and water [on a shaking
Nov. 20/05. table.]*

[Matter enclosed between rules erased in copy.]

In testimony whereof we have signed our names to this Specification in the presence of two subscribing witnesses.

HENRY LIVINGSTONE SULMAN.
HUGH FITZALIS KIRKPATRICK-PICARD.
JOHN BALLOT.

Two Witnesses:
GEO. J. B. FRANKLIN.
T. J. OSMAN.

[*Words and figures enclosed in brackets erased in copy.]

1987 *Oath.*

See Oath Filed Apr. 17/06.

LONDON,
England, ss:

Henry Livingstone Sulman, Hugh Fitzalis Kirkpatrick-Picard and John Ballot, the above named petitioners, being duly sworn, depose and say that they are subjects of the King of England and residents of London in England, and that they verily believe themselves to be the original, first, and joint inventors of the Improvements in "Ore Concentration," described and claimed in the annexed Specification; that they do not know and do not believe that the same was ever known or used before their invention or discovery thereof; or patented or described in any printed publication in any country before their invention or discovery thereof, or more than two years prior to this application; or patented in any country foreign to the United States on an application filed more than twelve months before this application; or in public use or on sale in the United States for more than two years prior to this application; and that no application for patent on said improvements has been filed by them or their representatives or assigns in any country foreign to the United States, except as follows: Great Britain No. 7803, dated 12th April, 1905, and Australia.

HENRY LIVINGSTONE SULMAN.
HUGH FITZALIS KIRKPATRICK-PICARD.
JOHN BALLOT.

Sworn to and subscribed before me this 17 day of May, 1905, by all three Deponents.

[NOTARIAL SEAL.] G. F. WARREN,
Notary Public.

[Revenue Stamp.]

1988 Consulate-General of the United States of America for Great Britain & Ireland at London.

I, Richard Westacott, Vice and Deputy Consul-General of the United States of America at London, England do hereby make known and certify to all whom it may concern that George Frederick Warren, who hath signed the annexed Certificate, is a Notary Public, duly admitted and sworn and practising in the city of London, aforesaid, and that to all acts by him so done full faith and credit are and ought to be given in Judicature and thereout.

In Testimony Whereof, I have hereunto set my hand and affixed my Seal of Office at London aforesaid, this Nineteenth day of May in the year of our Lord One Thousand Nine Hundred and five.

[CONSULAR SEAL.] ——— ———,
Vice and Deputy Consul-General.

1989 2–260.

Div. 25, Room 315.

Address only "The Commissioner of Patents, Washington, D. C."

Paper No. 1.

All communications respecting this application should give the serial number, date of filing, and title of invention.

M. E. C.

Department of the Interior,

United States Patent Office,

Washington, D. C., August 9, 1905.
Mailed " " "

Sulman, Kirkpatrick-Picard, and Ballot, care Knight Bros., City:

Please find below a communication from the Examiner in charge of your application, #262,889, filed May 29, 1905, for Ore Concentration.

F. I. ALLEN,
Commissioner of Patents.

Date is required as to the Australian application referred to in the oath; such data should be supported by affidavit. The filing date of the application referred to in line 6, page 5 should be inserted. The jetting means (last two lines, page 5) are required to be illustrated, as is also the apparatus for the alternative procedure described in the second paragraph of page 7, as well as the
1990 shaking table form recited in claim 9. The particular apparatus should not be made an essential of a process claim such as the 9th.

LEWIS B. WYNNE,
Examiner, Division XXV.

T. F. MITCHELL.

Patent Office,
Nov. 20, 1905.
Division XXV.

Serial No. 262,889, Paper No. 2.

Amendment.

Inventors: Sulman, Picard and Ballot. Invention: Ore Concentration. Filed May 29, 1905. Serial No. 262,889.

Hon. Commissioner of Patents.

SIR: The above named application is hereby amended as follows:

The Australian application was not filed at the time of filing of this application.

Page 5, to the end of line 6, add "filed February 20, 1905."

Page 6, to the end of line 1, add

—as illustrated in our previous application above referred to—.

It is thought that the requirement as to the showing of the jetting means should be waived in view of this amendment.

1991 An additional drawing will be filed showing the alternative procedure described on page 7.

Claim 9, lines 17 and 18, cancel "on a shaking table."

Respectfully submitted,

KNIGHT BROS., *Attorneys.*

Washington, D. C., November 18, 1905.

P.

2–260.

Div. 25, Room 315.

Address only "The Commissioner of Patents, Washington, D. C."

Paper No. 3.

All communications respecting this application should give the serial number, date of filing, and title of invention.

M. E. C.

Department of the Interior,
United States Patent Office,
Washington, D. C., November 23, 1905.
Mailed " " "

Sulman, Kirkpatrick-Picard, and Ballot, care Knight Bros., City:

Please find below a communication from the Examiner in charge of your application, #262,889, filed May 29, 1905, for Ore Concentration.

F. I. ALLEN,
Commissioner of Patents.

Case as amended November 20, 1905, further considered.

1992 The amendment inserted at the end of line 1, page 6, is nothing more than a reference to another application for details which should appear in this case. Such reference is not permissible. Illustration of the jetting means will therefore be insisted upon. It is required that the expression "water containing less than 1 per cent. of sulphuric acid" be replaced by one more definite in such claims as contain the expression. It may mean water without a trace of sulphuric acid. It is suggested that "water containing a fraction of 1 per cent. of sulphuric acid" be substituted.

The drawing should be filed at once. A complete response to an action dealing with formal matters must include response to every item.

LEWIS B. WYNNE,
Examiner, Division XXV.

T. F. MITCHELL.

1993 Application Room,
Apr. 17, 1906,
U. S. Patent Office.

Patent Office,
Apr. 18, 1906,
Division XXV.

Amend't and Oath.

Serial No. 262,889, Paper No. 4.

Room No. 315.

Amendment.

Inventors: Sulman, Kirkpatrick-Picard & Ballot. Invention: Ore Concentration. Filed May 29, 1905. Ser. No. 262,889.

Hon. Commissioner of Patents.

SIR: The above-named application is hereby amended as follows:—

A new oath is filed herewith.

The Examiner will kindly place "Fig. 1" on the original sheet.

Add the sheet of drawing filed herewith.

Referring to the original specification, on page 5, cancel lines 13, 14 and 15 and insert the following:

A. "In the accompanying drawings,

"Figure 1 is a diagram in perspective illustrating one form of apparatus suitable for carrying this invention into practice, and,

"Figure 2 represents *is* perspective an apparatus for carrying out a secondary step in the process."

1994 Page 5, line 16, change "A mixing" to *Referring to Fig.* 1 *a mixing*

Page 7, line 19, after "before" insert

A.[1] *This idea is* not claimed broadly in this case but forms the subject matter of an application filed by us on January 9, 1906, Ser. No. 295,326.

On page 7 of the original specification, three lines from the bottom, add:

A[2]. Referring to Fig. 2, a mixing vessel *a* (of which there may be several) in series) is provided with a rotatable stirer *b*. Crushed ore or similar finely divided mineral is fed into the vessel *a*. A pipe *c* controlled by a tap *c'* delivers circuit water to the vessel and in cases where oil is used, the oil is introduced through the pipe *d* in quantity sufficient to produce a thin coating of oil on these mineral particles for which oil has an affinity.

The pulp mixed with oil escapes over the lip of the discharge conduit a^1 and passes through the pipe a^2 to a pump *e*. Hence the pulp is pumped through discharge pipe *e'* into the closed chamber *f* which is constructed to withstand a considerable internal pressure and is provided with a safety valve *f'*, the pressure gauge f^2, and a gauge glass f^3 to indicate the level of the pulp in the chamber. An outlet pipe *g* having a cock *g'* leads to a series of spitzkasten *h* filled with circuit water.

The operation is as follows:

The cock *g'* is closed; pulp is pumped into the cham-
1995 ber *f* which contains air or other gas and the pumping is continued until the pressure in the chamber rises to, say, 50 to 100 lbs. per square inch. The pressure is sufficient to cause the air or other gas to be dissolved to a considerable extent in the pulp. After the lapse of a few minutes for the due solution of the compressed air or a portion of it by the pulp or the liquid, the cock *g'* is opened and the pulp is discharged into the open spitzkasten *h* where the liquid is of course under atmospheric pressure. The pump *e* may be during
Apr. 24/06. stopped ∧ [furing]* this discharge.

The whole of the mineral to which air bubbles are attached, say the oiled, mineral, at once rises to the surface as a coherent scum or froth. A surface current of water is maintained in the spitzkasten and the floating material is thus removed and separated from the gangue which remains sunk or suspended in the liquid."

Not entd. Corrected Apr. 24/06.

+ Page 5, cancel from and including "may" line 3, to and including "maximum" page 6, line 1.

Also cancel the insert at the end of line 1, page 6.

Claims 6, 7 and 8, line 3, change "less than" to *a fraction of*

[*Words and figures enclosed in brackets erased in copy.]

Cancel claim 9.
Insert the following claims:

A[3]. 9. The process of concentrating powdered ores which consists in separating the mineral from the gangue by coating the mineral with oil in water containing a small quantity of oil, agitating the mixture to form a froth, and separating the froth.

1996 10. The process of concentrating powdered ores which consists in separating the mineral from the gangue by coating the mineral with oil in water containing a small quantity of oil, warming the mixture, agitating the mixture to form a froth, and separating the froth.

11. The process of concentrating powdered ores, which consists in separating the mineral from the gangue by coating the mineral with oil in water containing a small quantity of oil, and a quantity of acid insufficient to cause chemical action on the metalliferous minerals present, agitating the mixture to form a froth, and separating the froth.

Canceled June 29/06.

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12. The process of concentrating powdered ore which consists in separating the minerals from gangue by coating the mineral with oil in water containing a fraction of 1% of oil on the ore, and recovering the oil coated minerals.

[Matter enclosed between rules erased in copy.]

12. [12.]* The process of concentrating powdered ore which consists in separating the minerals from gangue by coating the minerals with oil in water containing a fraction of 1% of oil on the ore, agitating the mixture to cause the oil coated mineral to form a froth, and separating the froth from the remainder of the mixture.

Canceled June 15/06.

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14. The herein described process of concentrating ores which consists in mixing powdered ores with water, adding a small proportion of oily liquid having a preferential affinity for metalliferous matter, (amounting to a fraction of

1997 1% on the ore) agitating the mixture until part of the oil-coated mineral matter forms into a froth, removing the froth, subjecting the remaining pulp to the action of a compressed gas in a closed chamber, and thereafter relieving the pressure whereby gaseous bubbles are liberated in the pulp and raise the oil-coated mineral particles to the surface.

[Matter enclosed between rules erased in copy.]

[*Words and figures enclosed in brackets erased in copy.]

Insert B, Apr. 24/06.

Respectfully submitted,

KNIGHT BROS., *Attorneys.*

Wash. D. C., April 14, 1906.

T.

KINGDOM OF GREAT BRITAIN AND IRELAND,
City of London, England, ss:

Henry Livingstone Sulman, Hugh Fitzalis Kirkpatrick-Picard, & John Ballot, being sworn, depose and say that they are subjects of the King of England, and residents of London, England, that they verily believe themselves to be the original, first and joint inventors of the improvement in Ore Concentration described and claimed in the application filed May 29, 1905, Ser. No. 262,889," that they do not know and do not believe that the same was ever known or used before their invention or discovery thereof, or patented or described in any printed publication in any country before their invention or discovery, or more than two years prior to this application, or patented in any country foreign to the United States on an appli-
1998 cation filed more than twelve months before this application, or in public use or on sale in the United States for more than two years prior to this application; and that no application for patent on said improvement has been filed by them or their representatives or assigns in any country foreign to the United States, except as follows:

Great Britain, April 12th, 1905, under No. 7803.

HENRY LIVINGSTONE SULMAN.
HUGH FITZALIS KIRKPATRICK-PICARD.
JOHN BALLOT.

Sworn to and subscribed before me this 3rd day of January, 1906.

[CONSULAR SEAL.] RICHARD WESTACOTT,
Vice and Deputy Consul-General of the United States of America at London, England.

1999 2-260.

Div. 25, Room 315.

Address only "The Commissioner of Patents, Washington, D. C."

Paper No. 5.

All communications respecting this application should give the serial number, date of filing, and title of invention.

M. E. C.

Department of the Interior,

United States Patent Office,

Washington, D. C., April 20, 1906.
Mailed " " "

Sulman, Kirkpatrick-Picard, and Ballot, care Knight Bros., City:

Please find below a communication from the Examiner in charge of your application, #262,889, filed May 29, 1905, for Ore Concentration.

F. I. ALLEN,
Commissioner of Patents.

Case amended April 17, 1906, further considered.

"Furing," last line, page 2 of the amendatory paper should be corrected. The data as to the cancellation directed on page 5 are incorrect; said amendment cannot be made until corrected data are furnished.

2000 In presenting claim 14, applicants make a change of election in shifting from the shaking-table step of original claim 9 to the air compression and flotation step. This change is made after the case has been twice acted on by the office, and is too late. Said claim 14 is required to be canceled. Applicants may, if they so desire, restore original claim 9.

LEWIS B. WYNNE,
Examiner, Div. XXV.

T. F. MITCHELL.

Application Room,
Apr. 24, 1906,
U. S. Patent Office.

Patent Office,
Apr. 25, 1906,
Division XXV.

Serial No. 262,889, Paper No. 6.

Amendment.

Room No. 315.

Inventors: Sulman, Picard & Ballot. Invention: Ore Concentration. Filed May 29, 1905. Serial No. 262,889.

Hon. Commissioner of Patents.

SIR: The above named application is hereby amended as follows:

In the amendment filed April 17th, page 2, last line, change "furing" to *during*.

Page 5, cancel matter beginning "and may" line 29 and ending page 6, line 1, with "maximum."

Insert the following claims—

B. 2001 13 [14 15].* The herein described process of concentrating ores which consists in finely powdering the ore, mixing it with water containing less than 1% of sulphuric acid, adding sufficient oleic soap solution to produce oleic acid amounting to 0.02–0.5% on the ore, warming the mixture to 30°–40° C., agitating the mixture until the oleic acid has been brought into efficient contact with the mineral, and has formed a froth with the finer mineral, distributing the mixture on the surface of a current of water running over columns of water, so that the coarser minerals and sands, the finer sands and the gangue slimes successively deposit out while the froth is floated away by the current, filtering off the froth and removing the oleic acid therefrom by treatment with an alkali and separating the coarser mineral from the sands by exposing them alternately to air and water.

We think the Examiner will upon reconsideration not hold that claims 14 and 15 are alternative.

Beginning page 6, line 15, applicant states that the material of the first spitzkasten is treated on the shaking table, while in lines 12 et seq., page 7, he states that the material of the second and third spitzkasten is treated by the process set forth in claim 14. It will thus be seen that the two steps may be employed together and, therefore, are not alternative.

Respectfully submitted,

KNIGHT BROS.,
Attorneys.

Washington, D. C., April 23, 1906.

P.

2002 2–260.

Div. 25, Room 315.

Address only "The Commissioner of Patents, Washington, D. C."

Paper No. 7.

All communications respecting this application should give the serial number, date of filing and title of invention.

[*Words and figures enclosed in brackets erased in copy.]

M. E. C.

Department of the Interior,

United States Patent Office,

Washington, D. C., April 26, 1906.
Mailed " " "

Sulman, Kirkpatrick-Picard, and Ballot, care Knight Bros., City:

Please find below a communication from the Examiner in charge of your application, #262,889, filed May 29, 1905, for Ore Concentration.

F. I. ALLEN,
Commissioner of Patents.

Case as amended April 24, 1906, further considered.

Applicants are again and finally required to cancel claim 14. Applicants specifically state that the method thereof is alternative with that covered by claim 15, and the fact that one may be substituted for the other for the treatment of part does not make 2003 them any the less alternative and independent processes.

The next step must be either compliance with this requirement or appeal to the Board of Examiners-in-Chief.

LEWIS B. WYNNE,
Examiner, Div. XXV.

T. F. MITCHELL.

Application Room,
June 15, 1906,
U. S. Patent Office.

Patent Office,
June 16, 1906,
Division XXV.

Serial No. 262,889, Paper No. 8.

Amendment.

Room No. 315.

Inventors: Sulman, Kirkpatrick-Picard & Ballot. Invention: Ore Concentration. Filed May 29, 1905. Ser. No. 262,889.

Hon. Commissioner of Patents.

SIR: The above-named application is hereby amended as follows—Cancel claim 14 and adjust the numerals of the remaining claims.

Respectfully submitted,

KNIGHT BROS.,
Attorneys.

Wash., D. C., June 15, 1906.

2004 2–260.

Div. 25, Room 315.

Address only "The Commissioner of Patents, Washington, D. C."

Paper No. 9.

All communications respecting this application should give the serial number, date of filing, and title of invention.

M. E. C.

Department of the Interior,

United States Patent Office,

Washington, D. C., June 18, 1906.
Mailed " " "

Sulman, Kirkpatrick-Picard, and Ballot, care Knight Bros., City:

Please find below a communication from the Examiner in charge of your application, #262,889, filed May 29, 1905, for Ore Concentration.

F. I. ALLEN,
Commissioner of Patents.

Case as amended June 15, 1906, further considered.

Claim 12 is rejected in view of 763,260, Cattermole, June 21, 1904; or 793,808, Sulman et al., July 4, 1905, Washers (H), as expressing merely a difference of degree thereover as to the proportion of oily matter employed.

LEWIS B. WYNNE,
Examiner, Div. XXV.

T. F. MITCHELL.

2005 Application Room,
June 29, 1906,
U. S. Patent Office.

Patent Office,
Jun- 30, 1906,
Division XXV.

Serial No. 262,889, Paper No. 10,

Amendment.

Room No. 315.

Inventors: Sulman, Picard & Ballot. Invention: Ore Concentration.
Filed May 29, 1905. Serial No. 262,889.

Hon. Commissioner of Patents.

SIR: The above named application is hereby amended as follows: Cancel claim 12 and adjust the numerals of the remaining claims.

Respectfully submitted,

KNIGHT BROS.,
Attorneys.

Washington, D. C., June 28, 1906.

P.

2006 A. R.

Serial No. 262,889.

Issue Division.

All communications should be addressed to "The Commissioner of Patents, Washington, D. C."

Department of the Interior,

United States Patent Office,

Washington, D. C., July 6, 1906.

Henry L. Sulman, Hugh F. Kirkpatrick-Picard, and John Ballot, c/o Knight Bros., City.

SIR: Your application for a patent for an improvement in Ore Concentration, filed May 29, 1905, has been examined and allowed.

The final fee, Twenty Dollars, must be paid, and the Letters Patent bear date as of a date not later than six months from the time of this present notice of allowance.

If the final fee is not paid within that period the patent will be withheld, and your only relief will be by a renewal of the application, with additional fees, under the provisions of Section 4897, Revised Statutes. The office aims to deliver patents upon the day of their date, and on which their term begins to run; but to do this

properly applicants will be expected to pay their final fees at least twenty days prior to the conclusion of the six months allowed them by law. The printing, photolithographing, and engrossing
2007 of the several patent parts, preparatory to final signing and sealing, will continue the intervening time, and such work will not be done until after payment of the necessary fees.

When you send the final fee you will also send, distinctly and plainly written, the name of the inventor and title of invention as above given, date of allowance (which is the date of this circular), date of filing, and, if assigned, the names of the assignees.

If you desire to have the patent issue to assignees, an assignment containing a request to that effect, together with the fee for recording the same, must be filed in this office on or before the date of payment of final fee.

After issue of the patent uncertified copies of the drawings and specifications may be purchased at the price of five cents each. The money should accompany the order. Postage stamps will not be received.

Respectfully,

F. I. ALLEN,
Commissioner of Patents.

In remitting the final fee give the serial number at the head of this notice.

Uncertified checks will not be accepted.

2008 2–327.

$20.00 Received Oct. 16, 1906. H. Chief Clerk, U. S. Patent Office.

Memorandum of Fee Paid at United States Patent Office.

(Be careful to give correct Serial No.)

Serial No. 262,889. —— —, 190–.
Inventors: H. L. Sulman, H. T. Kirkpatrick Picard & J. Ballot.
Patent to be issued to —— ——.
Name of invention, as allowed: Ore Concentration.
Date of payment: Oct. 16, 1906.
Fee: $20.00.
Date of filing: May 29-05.
Date of circular of allowance: July 6, '06.

The Commissioner of Patents will please apply the accompanying fee as indicated above.

KNIGHT BROS., *Attorneys.*

Send patents to Knight Bros., McGill Bldg., City.

2009 2–191.

J. M. H.

Serial No. 262,889.

Address only "The Commissioner of Patents, Washington, D. C."

Department of the Interior,

United States Patent Office,

Washington, D. C., Oct. 18, 1906.

Henry Livingstone Sulman, Hugh Fitzalis Kirkpatrick-Picard and John Ballot, c/o Knight Bros., McGill Building, Washington, D. C.

SIR: You are informed that the final fee of twenty dollars has been received in your application for Improvement in Ore Concentration.

Very respectfully,

F. I. ALLEN,
Commissioner of Patents.

[Here follows printed copy of Patent 835,120.]

2010 1905.

Contents.

83. Mills,
Ore and Coal Washers.

Print, —— —, ——.
Application, — papers.
1. Letter, Aug. 9, 1905.
2. Amendment, Nov. 20, 1905.
3. Letter, Nov. 23, 1905,
and Oath.
4. Amendt. A, Apr. 17, 1906.
5. Letter, Apr. 20, 1906.
6. Amendt. B, Apr. 24, 1906.
7. Letter, Apr. 26, 1906.
8. Amendment, June 15, 1906.
9. Rej., June 18, 1906.
10. Amendment, June 29, 1906.
11.
12.
13.
14.
15.
16.
17.
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21.
22.
23.

Title: Improvement in Ore Concentration.

2011 DEFENDANT'S EXHIBIT.

Certified Copy of File-wrapper and Contents of Kirby Patent No. 838,626.

United States of America,

Department of the Interior,

United States Patent Office.

To all to whom these presents shall come, Greeting:

This is to certify that the annexed is a true copy from the Records of this Office of the File Wrapper and Contents, in the matter of the

Letters Patent of Edmund B. Kirby, Number 838,626, Granted December 18, 1906, for Improvement in Separating-Tanks.

In testimony whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed at the City of Washington, this 3rd day of June, in the year of our Lord one thousand nine hundred and twelve and of the Independence of the United States of America the one hundred and thirty-sixth.

[SEAL.] F. A. TENNANT,
Acting Commissioner of Patents.

2012 2–437.

Number (Series of 1900).
185,475.

1903.

Div. 25.
(Exr.'s Book) 43-115.

Patent No. 838,626.
Name: Edmund B. Kirby, of Rossland, State of Canada.
Invention: Separating Tank.

Parts of application filed	Original.	Renewed.
Petition,	Dec. 17, 1903,	—— —, 190-.
Affidavit,	" " 1903,	—— —, 190-.
Specification,	" " 1903,	—— —, 190-.
Drawing 2 shts.,	" " 1903,	—— —, 190-.
Model or Specimen Not reqd.,	—— —, 190–,	—— —, 190-.
First Fee, Cash $15.00,	Dec. 17, 1903,	—— —, 190-.
1. " " Cert.,	—— —, 190–,	—— —, 190-.
App. filed complete,	Dec. 17, 1903,	—— —, 190-.
Examined, Lewis B. Wynne,	May 21st, 1906,	—— —, 190-.
Countersigned, R. E. Grant, For Commissioner.		—— —, 190-. For Commissioner.
Notice of Allowance	May 24, 1906,	—— —, 190-.
Final Fee, Cash —,	—— —, 19—,	—— —, 190-.
2. " " Cert. $20,	Nov. 24, 1906,	—— —, 190-.

Patented December 18, 1906.
Nov. 24, 1906,
Sub.
Associate Attorney, *Thurston*, Bates *and Woodward.*
Attorney-, Thurston & Bates,
1028 Soc. for Sav. Bldg., Cleveland, Ohio.
3. Name, —— ——. Serial Number, ——.
Patent No. —. Date of Patent, ——.

[On left margin:] Division of App. No. —, filed —— —, 190-.

2013 $15, ck., Received Dec. 17, 1903. L. Z. A. Chief Clerk, U. S. Patent Office.

Dec. 15, 1903.

Commissioner of Patents, Washington, D. C.

DEAR SIR: In the matter of the application about to be filed by Edmund B. Kirby, for Separating Tanks, executed December 4, 1903, we hand you herewith by mail the following:—

Petition and Power of Attorney.
Specification,
Oath,
Two Sheet- of Drawings.
Government Fee: $15.00 enclosed in our check.

Yours truly,

THURSTON & BATES.

Mail Room,
Dec. 17, 1903,
U. S. Patent Office.

Serial No. 185,475, Paper No. 1/2.

Application. 1903.

To the Commissioner of Patents:

Your petitioner, Edmund B. Kirby, a citizen of the United States residing at Rossland, in the Province of British Columbia, and Dominion of Canada, whose Post Office address is Rossland, British Columbia, Canada, prays that Letters Patent may be granted
2014 to him for the improvement in Separating Tanks, set forth in the annexed specification.

And he hereby appoints the firm of Thurston & Bates, (Reg. #1130), of Cleveland, Ohio, (said firm consisting of E. L. Thurston and Albert H. Bates) his attorneys, with full power of substitution and revocation, to prosecute this application, to make alterations and amendments therein, to sign the drawings, to receive the patent, and to transact all business in the Patent office connected therewith.

Signed at Northport, in the County of Stevens and State of Washington, this fourth day of Dec. 1903.

EDMUND B. KIRBY.

Specification.

To all whom it may concern:

Be it known that I, Edmund B. Kirby, a citizen of the United States, residing at Rossland, in the Province of British Columbia and Dominion of Canada, have invented a certain new and useful improvement in Separating Tanks, of which the following is a full,

clear and exact description, reference being had to the accompanying drawings.

The object of this invention is to effect with substan-
Apr. 4/05. tial completeness, the segg*r*egation of those pulverized mineral particles which have a preferential adhesion for water from those which have a prefertnial adhesion for a liquid immiscible in water,—for example oil or a solution of bitumen in kerosene. This invention is for the treatment of the
2015 charge after the pulverized mineral, the oil or solution and the water have been thoroughly mixed together, whereby nearly all of the mineral particles which exhibit adhesive preference for the oil or solution have been coated therewith. The invention is most useful when used to carry on one step of a process of my own invention, wherein the immiscible liquid employed is thin and light, as for example, a solution of bitumen in kerosene. But the invention is also useful with oil processes for separating mineral particles. This invention, which relates to the separator tank and its co-operating adjuncts, may be here summarized as consisting in the construction and combinations of parts shown in the drawing and hereinafter described, as definitely set forth in the claims.

In the drawing figure 1 is an elevation partly in vertical section of an apparatus embodying my invention. Figure 2 is a plan view thereof; Figure 3 is a vertical sectional view of the agitator shaft and a part of one side of the tank; and figure 4 is a sectional plan view of the said shaft and one of the agitator arms secured thereto below the section line.

The tank A is preferably cylindrical. Into it is to be charged the materials to be separated, to wit, pulverized ore, water, and some liquid lighter than water and immiscible therein, which will adhere only to the metallic mineral part of the pulverized ore,—said materials having, preferably, been thoroughly mixed in another tank.

The immiscible liquid may, as stated, be oil, or a light hy-
2016 drocarbon, or a solution of bitumen in a light hydrocarbon. The apparatus was especially designed for use with a charge consisting of ore, water and solution of bitumen in kerosene,—and therefore, the immiscible liquid will, for convenience of description, be referred to herein as the "solution." The charge should be very fluid, and should preferably contain three or four times as much water as mineral,—some of which water may be added to the mixture after it has been transferred to the tank A.

Most of the solution and the solution-coated mineral particles rise immediately to the surface, from which they may be skimmed; but considerable quantities of the solution-coated concentrates are enveloped by and entrapped in the sands which settle to the bottom of the tank. For the primary purpose of freeing these particles from the sand and permitting them to float on the surface, the vertical rotating agitator shaft B, and its adjuncts, are provided. Arms D are secured to this shaft near the bottom of the tank; and as the shaft slowly rotates they gently lift the mass of sands from the bottom and overturn it, and prevent it from packing, and thus permit the solution-coated particles to escape and float to the surface. These arms D

are provided near their outer ends with lifting plows E whose front faces are set at an angle of about 45 degrees. To these arms, between the plows and the central shaft B, are secured inclined scraper blades F which act to gradually push the material outward into the path of the plows.

2017 It is very desirable that some gas, preferably air, shall be blown into the charge near the bottom thereof. This gas assists in agitating the charge, but its chief value is in the assistance it renders in floating the solution-coated particles to the surface. It is clear that some of these particles may be so large and heavy that the coating thereon may not be able to buoy them up,—this being especially true in case the liquid used is thin and light,—as the kerosene-bitumen solution. The gas bubbles, however, not only tend to attach themselves to the solution-coated particles and to buoy them up, after the fashion of balloons, but the water is caused to dissolve the gas to its maximum capacity. This dissolved gas tends to again separate from the water, and attach itself in minute globules to the solution-coated particles, thus buoying them up and assisting their flotation. It is thought that any gas which will not chemically combine with the charge may be employed in the manner and for the purpose stated, but it is definitely known that air, carbon dioxide, hydrogen, and marsh gas may be so used,—air appearing to be rather the most efficient as well as the cheapest.

This gas may be injected in any way, and by any means; but very efficient means for this purpose are shown in the drawings,—said means consisting generally in making the shaft B and arms D hollow, and providing the latter with discharge openings, and blowing the gas down through the shaft. The specific construction is as

2018 follows: The head of the shaft above the driving gear b^4 is provided with a solution and air box G which remains stationary while the shaft revolves, and is supplied by the solution pipe H and air pipe L. The box rests on the rotating shoulder b of the shaft B, and is held down to a tight joint by the collar b' and lock nut cap b^2. Through the hollow shaft B extends a small solution pipe K the upper end of which is firmly inserted within the upward extension of the shaft and moves with, and as a part of it. Air enters the annular chamber g in said box, passing through a set of apertures g' to the interior of shaft B. The solution enters a small annular chamber g^2 from which it passes by apertures g^3 into the top of the central pipe K. The air current for the charge passes down through the shaft into the hollow arms D from which it passes out through drop pipes d. The solution is delivered from the pipe K to a series of radiating pipes k, which are secured to the arms D, and is discharged from branch pipes k'. This solution tends to attach itself to those particles, not already coated, but which it will adhere to, and thus assists their flotation. The introduction of air and solution renders the separation substantially complete, that is to say it causes substanially all of the particles which exhibit preferential adhesion for the solution to become coated thereby and floated to the surface.

The shaft B at its lower end has a stepped bearing which is supported on a pedestal M, provided with a wooden block m, which sup-

ports the moving wear plates m' of the shaft. Lubricating
2019 water, under pressure, is introduced through the pipe O and finds
Apr. 4/05. ^ [fings]* its way out from the bearing into the tank. The sides b^5 of the shaft are carried down below the bearing so as to leave an annular space between them and the pedestal. This annular space is intended to constitute an air bell designed to assist the lubricating water in excluding sand from the bearing. The air supplied to it is maintained by a small stream of air which escapes beneath the bell through the pipe O'.

A spiral skimming bar P (two are shown) which is preferably secured to the rotating shaft B so as to extend through the floating layer of concentrates, solution and air bubbles, acts to direct this floating layer into the settling chamber R, and to overflow outlet a^3.. This chamber is separated from the rest of the tank by a partition r, the upper edge of which, between the points r and r', is submerged sufficiently to allow the floating layer and some of the muddy water to pass over it, while the edge of this partition, between the points r and r^2, is raised above the liquid so as to retain everything passing into it. There is an overflow outlet a^3 from this settling chamber through the side of the tank,—which outlet is partly surrounded by the elevated part of this partition.

Owing to the agitation within the tank, caused by movement of the arms and the rising air bubbles, the water even near the top is not clear, but turbid or muddy with slimes or fine particles of the non-coated minerals, which do not settle rapidly enough to get out
2020 of the way. The floating concentrates are carried mainly at the lower surface of the floating layer where it is in contact with the water. The bottom of the overflow outlet must be below the surface level of the water in order to clear them, and must therefore allow a portion of the water to pass out with the skimmings. This muddy water would therefore carry its suspended particles of the worthless minerals, which would make the concentrates impure.

The settling and washing chamber is designed to lessen or prevent this evil. As the floating material passes over its submerged edge it escapes from the swift current and arising air bubbles, so that in its comparative quiet the slimes have a better opportunity to settle out of the way. The box is divided into compartments by submerged partitions r^4, as shown, each compartment terminating in a hopper shaped bottom, with discharge openings r^5 through which the settled slimes may pass out again into the tank. Projecting shields r^6 prevent the air bubbles from entering the hoppers and disturbing their quiet.

The passage of the floating material over several of these hoppers settles most of the slime before reaching the overflow outlet. Before reaching the outlet, however, the skimmings pass over a stream of clean wash water, introduced at the point s' through the pipe S shown. This wash water is delivered under constant head from a supply tank. Its quantity is made equal to that passing out through

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[*Words and figures enclosed in brackets erased in copy.]

2021 the discharge gate with the skimmings; so that this discharge, being supplied entirely by the pure water close at hand, contains little or none of the muddy water which is thus held back in the tank. It is evident that the incoming and outgoing streams are self-adjusting, because if too much enters, the general level rises and a large stream flows from the orifice. The flow of floating layer over the submerged partition of the settling chamber, and on to the overflow outlet may be induced by properly directed air jets blown onto said floating layer from jet openings *t* in one or more pipes T.

Having described my invention, I claim:

Canceled Mar. 21/04.

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1. The combination of a tank having an overflow-outlet, a rotary agitator, and means directing the floating surface layer to said overflow outlet, substantially as described.

[Matter enclosed between rules erased in copy.]

Canceled Mar. 24/05.

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1. [2.]* The combination of a tank having an overflow outlet, curved
Mar. 24/05. with a rotatable agitator, and a ^ skimming bar secured thereto and adapted to direct the floating layer of coated concentrates toward said overflow outlet, substantially as specified.

[Matter enclosed between rules erased in copy.]

1. [2, 3.]* The combination of a separating tank having an overflow outlet, and a submerged
" " " settling chamber in said tank discharging through
rotatable [curved]*
Mar. 2/05. said outlet, with a ^ skimming bar supported in said tank for directing the floating layer of concentrates into said settling chamber and toward said overflow outlet, substantially as specified.

2022 2. [3, 4.]* The combination of a separating tank containing a submerged settling chamber at one side thereof,—through whose side there is an overflow outlet from said chamber,—said chamber being formed by a partition which is partly submerged, and said chamber being divided into a plurality of hopper shaped compartments, each having a discharge opening through its lower end, substantially as specified.

3. [4, 5.]* The combination of a separating tank containing a submerged settling chamber at one side thereof,—through which side there is an overflow outlet from said chamber,—said chamber being formed by a partition which is partly submerged, and said

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[*Words and figures enclosed in brackets erased in copy.]

chamber being divided into a plurality of hopper shaped compartments, each having a discharge opening through its lower end, and a shield below each of said discharge openings, substantially as specified.

4. [5, 6.]* The combination of a separating tank containing a submerged settling chamber at one side thereof, said settling chamber having an overflow outlet through one side of the tank, and said settling chamber being formed by a submerged partition which projects above the surface of the fluid charge around said outlet but is at other places submerged below the floating layer on the surface of said charge, with a skimming bar which is supported in the tank and is adapted to direct said floating layer over the submerged top of said partition into the settling chamber and toward the overflow outlet therefrom, substantially as specified.

2023 5. [6, 7.]* The combination of a tank having an overflow outlet, and a vertical rotatable shaft in said tank having agitator arms located near the bottom of the tank, with a submerged settling chamber in said tank discharging through said overflow outlet, the inner partition of said chamber being extended around said outlet above the surface of the liquid charge and being submerged at other points below the floating layer of concentrates, and a spiral skimming bar secured to the shaft so as to project through said layer whereby it directs the layer of concentrates into said settling chamber, substantially as described.

Canceled Mar. 21/04.

[8.]* The combination of a tank having an overflow outlet, agitating mechanism therein, means for washing the floating layer, and means for collecting said layer and directing it to said outlet, substantially as described.

[Matter enclosed between rules erased in copy.]

6. [9, 7.]* A separating tank having a submerged settling chamber at one side, and an overflow outlet from said chamber through said side, the inner wall of said chamber being above the surface of the fluid adjacent to said outlet, but submerged at other points below the floating layer of concentrates, and a pipe discharging clean wash water into said settling chamber close to said outlet, substantially as specified.

Canceled Mar. 21/04.

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10. The combination of a separating tank containing agitating mechanism, with means for discharging a gas into the contained fluid charge, substantially as specified.

[Matter enclosed between rules erased in copy.]

2024 7. [11, 8.]* The combination of a separating tank containing agitator mechanism, with means for discharging into

[*Words and figures enclosed in brackets erased in copy.]

the contained fluid charge a gas and liquid lighter than water and immiscible therewith, substantially as specified.

Canceled Mar. 21/04.

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12. The combination of a separating tank containing a hollow rotating shaft, and hollow agitating arms connected therewith having discharge openings, whereby one may force a gas down through said shaft and arms and out of said discharge openings, substantially as specified.

[Matter enclosed between rules erased in copy.]

8. [13, 9.]* The combination of a separating tank, a hollow shaft rotatably mounted therein having hollow connected agitator arms which are provided with a plurality of discharge openings, a pipe extending through said shaft, branch pipes connected with said pipe and extending toward the sides of the tank and having downward directed discharge openings, and means for forcing gas down through said shaft, and means for forcing a liquid down through said pipe, substantially as specified.

9. [14, 10.]* The combination of a separating tank, a rotatable agitator shaft therein having arms secured to it near the bottom of the tank, said arms having lifting plows near their outer ends and inclined scrapers between said plows and the shaft, substantially as described.

2025 Canceled Mar. 21/04.

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15. The combination of a tank, with a vertical agitator shaft therein having a bell shaped lower end, a pedestal which is embraced by said lower end whereby the shaft is supported, and means for discharging water into said bell shaped shaft end, substantially as specified.

[Matter enclosed between rules erased in copy.]

10. [16, 11.]* The combination of a tank, with a vertical agitator shaft therein having a bell shaped lower end, a pedestal which is embraced by said lower end whereby the shaft is supported, and means for discharging water into said bell shaped shaft end, and means for discharging a gas into said bell-shaped end, substantially as specified.

Sub. A, Mar. 21/04.

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17. The combination of a separating tank having an overflow outlet, agitating mechanism, and means of discharging jets of air

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[*Words and figures enclosed in brackets erased in copy.]

onto the floating surface layer to move it toward the overflow outlet, substantially as specified.

[Matter enclosed between rules erased in copy.]

11. [13, 18.]* The combination of a separating tank having an overflow outlet, agitating mechanism, a skimming bar, and a pipe having jet openings arranged over the surface of the charge in the tank to move the floating surface layer toward said overflow outlet, substantially as specified.

In testimony whereof, I hereunto affix my signature in the presence of two witnesses.

EDMUND B. KIRBY.

Witnesses:

T. L. SAVAGE.
E. T. EASTMAN.

2026 STATE OF WASHINGTON,
County of Stevens, ss:

Edmund B. Kirby, the above named petitioner, being duly sworn, deposes and says that he is a citizen of the United States and a resident of Rossland, in the province of British Columbia and Dominion of Canada, and that he verily believes himself to be the original, first and sole inventor of the improvement in Separating Tanks, described and claimed in the annexed specification; that he does not know and does not believe that the same was ever known or used before his invention or discovery thereof; or patented or described in any printed publication in the United States of America or any foreign country before his invention or discovery thereof or more than two years prior to this application; or in public use or on sale in the United States for more than two years prior to this application; and that no application for foreign patent on said invention has been filed by him or his legal representatives or assigns, in any foreign country.

EDMUND B. KIRBY.

Sworn to and subscribed before me, this 4th day of December, 1903.

[SEAL.] JOHN A. KELLOGG,
Notary Public.

Notary Public for State of Washington, residing at Northport, Washington.

[*Words and figures enclosed in brackets erased in copy.]

2027 2–260.

M. E. C.

Div. —, Room No. 315.

Address only "The Commissioner of Patents, Washington, D. C."

Paper No. 1.

All communications respecting this application should give the serial number, date of filing, and title of invention.

Department of the Interior,

United States Patent Office,

Washington, D. C., January 29, 1904.
Mailed " " "

Edmund B. Kirby, care Thurston & Bates, Cleveland, Ohio:

Please find below a communication from the Examiner in charge of your application, #185,475, filed December 17, 1903, for Separating Tank.

F. I. ALLEN,
Commissioner of Patents.

"Seggregation", line 2, page 2, should be changed to "segregation" *b* should be inserted in the drawing. "Fings," page 5, line 16, should be changed to "finds." The submergence of the wall of the chamber R between the points *r* and *r'* must be shown in the drawing, as must the elevation of the rest of the wall.

Claim 1 is rejected in view of 228,125, Seymour, May 28,
2028 1880; 354,104, Deam, December 14, 1886; or 482,582, Meinicke, Sept. 13, 1892, Washers, D.

Claim 2 is rejected in view of Deam and Meinicke, cited.

Claim 3 fails to distinguish patentability from 396,400, Guild, January 22, 1889, Steam Boilers, Cleaners.

Claim 4 may possibly be allowed, as may also claims 5, 6 and 7.

Claim 8 is rejected in view of the references for claim 1.

Claim 9 may possibly be allowed.

Claim 10 is rejected in view of 682,412, Perry, Sept. 24, 1901, Metallurgy, Solution and Precipitation, Apparatus.

Claim 11 is rejected in view of 725,609 Wolfe, April 14, 1903; 469,599, Rouse, Feb. 23, 1892, Washers, A, and any instance in which gas is employed in conjunction with oil for separating minerals—

British patent 12,778, Lake, June 4, 1902, Washers.

Claim 12 is rejected in view of Perry, cited.

Claim 13 may possibly be allowed.

Claim 14 fails to distinguish patentability from 73,839, Rivot, January 28, 1868, Grinding Mills, Chasing.

Claim 15 is regarded as lacking invention in view of 525,443, Carman et al., Sept. 4, 1894, Grinding Mills, Compound Movement; and 650,581, Ernsberger, May 29, 1900, Amalgamators, Plate. See also 445,430, McLanahan et al., Jan. 27, 1891, Washers, F.

Claim 16 may possibly be allowed.

2029 Claim 17 is rejected in view of 325,104, McCormick, August 25, 1885, Washers, C, and 479,453, Peck, July 26, 1892, Washers, D.

Claim 18 may possibly be allowed.

LEWIS B. WYNNE,
Examiner, Division XXV.

T. F. MITCHELL.

Mail Room,
Mar. 21, 1904,
U. S. Patent Office.

Patent Office,
Mar. 22, 1904,
Division XXV.

Serial No. 185,475, Paper No. 2.

Room No. 315.

Cleveland, O., March 18, 1904.

The Hon. Commissioner of Patents, Washington, D. C.

DEAR SIR: In the matter of the application of Edmund B. Kirby, No. 185,475, filed December 17, 1903, for Separating Tank,

Amendment is made as follows:

1. Cancel claims 1, 8, 10, 12 and 15.
2. In claim 2 insert the word *curved* before the word "skimming," in line 2.

2030 3. In claim 3 insert the word *curved* before the word "skimming," in line 3.

4. Cancel claim No. 17, and substitute therefor the following:

Canceled Mar. 24/05.

A. 12. The combination of a separating tank, having an overflow outlet, agitating mechanism in said tank, and a pipe, arranged above the surface of the charge in said tank, and having jet openings which are directed at an angle on to the surface of the charge and toward said overflow outlet, substantially as specified.

[Matter enclosed between rules erased in copy.]

5. Renumber the remaining claims, in order.

Respectfully,

EDMUND B. KIRBY,
By THURSTON & BATES,
His Attorneys.

Remarks.

The references cited against claim 2 fail to show a curved skimming bar *secured to the rotating agitator*, and therefore do not appear to meet the terms of this claim.

The reference cited against claim 3 probably met the second claim as originally presented. It is now amended to include a *curved* skimming bar, which the reference does not show, and we therefore request its allowance.

Claim 8, which was originally Claim 11, specifies means for discharging into the tank, not only a gas, but oil, and for this
2031 reason it does not appear to us that this reference cited affords sufficient grounds for rejection.

Claim 10, which was originally Claim 14, describes a construction which, in operation, not only lifts the pulverized ore from the bottom of the tank, but creates a circulation of the fluid and mineral particles held in suspension,—the path of said circulation being upward near the tank walls, and downward near the center of the tank. The inclined scrapers take the granular material, which falls to the bottom, near the center of the tank, and push it outward, to points where the lifting plows, which are secured to the outer ends of the arms, lift it as stated. The claim is specific, being limited to the particular relative arrangement of the lifting plows and inclined scrapers, and, therefore, the Rivot patent does not seem to anticipate it.

We request an early and favorable action.

Respectfully,

THURSTON & BATES.

2032 2-260.

M. E. C.

Div. 25, Room 315.

Address only "The Commissioner of Patents, Washington, D. C."

Paper No. 3.

All communications respecting this application should give the serial number, date of filing, and title of invention.

Department of the Interior,

United States Patent Office,

Washington, D. C., April 11, 1904.
Mailed " " "

U. S. Patent Office

Edmund B. Kirby, care Thurston & Bates, Cleveland, Ohio:

Please find below a communication from the Examiner in charge of your application, #185,475, filed December 17, 1903, for Separating Tank.

F. I. ALLEN,
Commissioner of Patents.

Case as amended March 21, 1904, further considered.

Claim 1 is rejected in view of the previously cited references, (Deam and Meinicke) and 258,578, Hamilton, May 30, 1882, Amalgamators, Lead. In view of Hamilton, the curvature of a skimming bar cannot impart patentability.

Since claim 2 does not specify a rotating skimming bar, the
2033 stationary curved bar of Guild meets the 2nd claim. The bar should be specified as rotatable.

Claims 3, 4, 5, and 6 and 7 have been allowed.

Claim 8 may possibly be allowed.

Claim 9 has been allowed.

Claim 10 may possibly be allowed.

Claim 11 has been allowed.

Claim 12 is rejected in view of 393,454, Shields, Nov. 27, 1888, Amalgamators, Mercury. See also 414,962, Anderson, Nov. 12, 1889, Washers, A.

Claim 13 has been allowed.

LEWIS B. WYNNE,
Examiner, Division XXV.

T. F. MITCHELL.

Mail Room,
Mar. 24, 1905,
U. S. Patent Office.

Patent Office,
Mar. 25, 1905,
Division XXV.

Serial No. 185,475, Paper No. 4.

Room No. 315.

Cleveland, Ohio, March 20, 1905.

Commissioner of Patents, Washington, D. C.

DEAR SIR: In the matter of the application of Edmund B. Kirby for Separating Tanks, filed Dec. 17, 1903, Serial No. 185,475, last Office action April 11, 1904.

Amendment is made as follows:

2034 1. In claim 2, original 3, line 3, before the word "skimming" cancel the word "curved," and substitute *rotatable;* this amendment is made in conformance with the examiner's suggestion in order to render the claim allowable.

2. Cancel claims 1 and 12. It is thought that the above amendment places the case in condition for allowance, and it is requested that if so it be passed to issue.

Respectfully,

E. B. KIRBY,
By THURSTON & BATES, *Attys.*

2035 2-260.

Div. 25, Room 315.

Address only "The Commissioner of Patents, Washington, D. C."

Paper No. 5.

All communications respecting this application should give the serial number, date of filing, and title of invention.

Department of the Interior,

United States Patent Office,

Washington, D. C., March 29, 1905.
Mailed " " "

Edmund B. Kirby, care Thurston & Bates, 1028 Soc. for Sav. Building, Cleveland, Ohio:

Please find below a communication from the Examiner in charge of your application, #185,475, Separating Tank, filed Dec. 17, 1903.

F. I. ALLEN,
Commissioner of Patents.

Case as amended Mar. 24, 1905, further considered.

The case awaits compliance with the formal requirements expressed in the first five typewritten lines of the office letter of Jan. 20, 1904.

LEWIS B. WYNNE,
Exr., Div. XXV.

T. F. MITCHELL.

2036 Mail Room,
Apr. 4, 1905,
U. S. Patent Office.

Patent Office,
Apr. 5, 1905,
Division XXV.

Serial No. 185,475, Paper No. 6.

Room 315.

Apr. 3rd, 1905.

Commissioner of Patents, Washington, D. C.

DEAR SIR: In the matter of the application of Edmund B. Kirby, for Separating Tanks, filed Dec. 17th, 1903, Serial No. 185,475, last Office Action March 29th, 1905.

Amendment is made as follows:

1. Page 2, line 2,—change "seggregation" to *segregation*.
2. Page 5, line 16,—change "fings" to *finds*.

Examiner is requested to kindly apply the reference letter *b* to the rotating shoulder of the shaft B on which the box G rests.

The draftsman has been requested to correct the drawings so as to show the submergence of the wall R between the points *r* and *r'*. It is thought that the elevation of the wall R between *r r²* is sufficiently plain from the drawings as they will appear when the above correction has been made.

Respectfully,

E. B. KIRBY,
By THURSTON & BATES,
His Attorneys.

2037 *Account.*

Serial No. 185,475, Paper No. 6½.

Account, Apr. 4/05.

Filed —— —, 190-.

Edmund B. Kirby. Ser. No. 185,475. Separating Tanks. Filed Dec. 17th, 1903.

April 3rd, 1905.

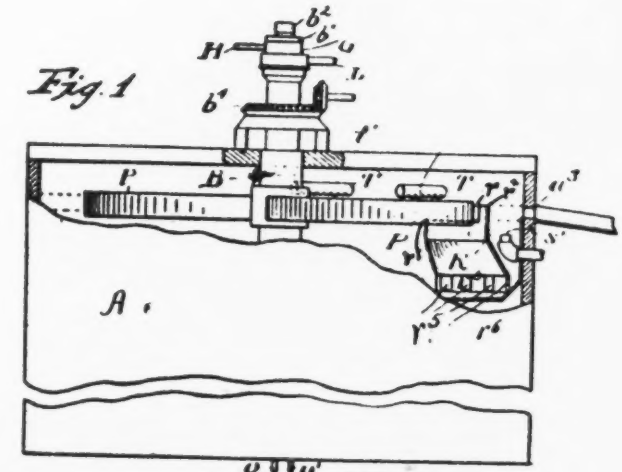
To the Hon. Commissioner of Patents, Washington, D. C.

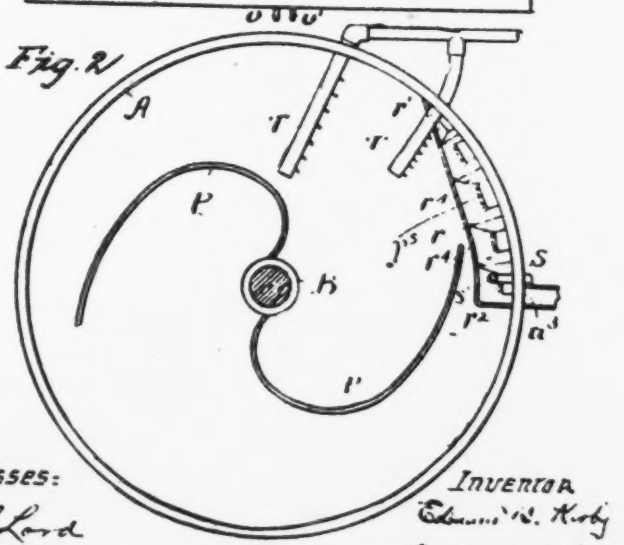
SIR: Please have a print made of the drawings in the above entitled case, and have the draftsman correct said drawings to comply with the Examiner's requirement of Jan. 20th, 1904, that the wall of the chamber R should be shown as submerged between the points *r r'*,—and charge the same to our account.

Respectfully,

THURSTON & BATES.

2038





Witnesses:
A. L. Lord
B. E. Brown

Inventor
Edmund S. Kirby
By Edwin H. Sabin
Attorneys

2039

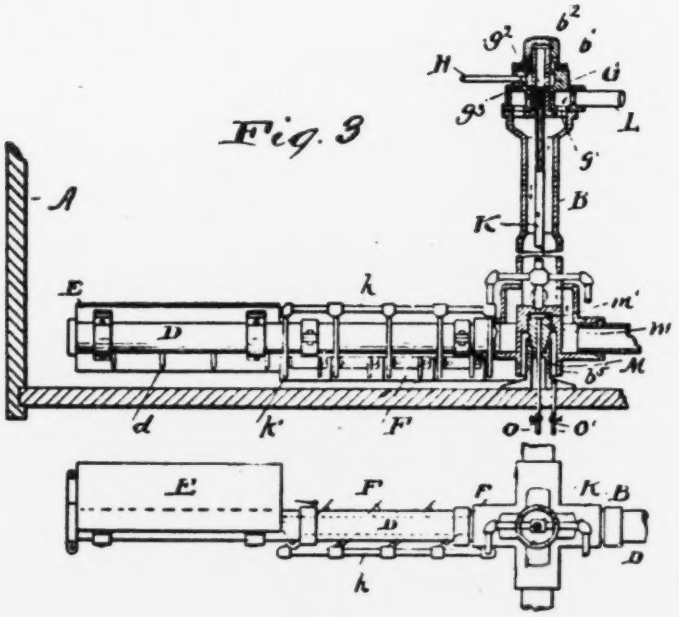


Fig. 3

Fig. 4

Witnesses.
A. L. Lord
B. W. Brockett

Inventor
Edmund B. Kirby
By Thurston & Babcock
Attorneys

2040 2–260.

M. E. C.

Div. 25, Room 315.

Address only "The Commissioner of Patents, Washington, D. C."

Paper No. 7.

All communications respecting this application should give the serial number, date of filing, and title of invention.

Department of the Interior,

United States Patent Office,

Washington, D. C., April 27, 1905.
Mailed " " "

U. S. Patent Office.

Edmund B. Kirby, care Thurston and Bates, Cleveland, Ohio:

Please find below a communication from the Examiner in charge of your application, #185,475, filed December 17, 1903, for Separating Tank.

F. I. ALLEN,
Commissioner of Patents.

Case as brought up by letter filed April 4, 1905, considered. Applicant is required to supply a sketch clearly indicating the changes to be made in the drawing.

LEWIS B. WYNNE,
Examiner, Division XXV.

T. F. MITCHELL.

2041 Mail Room, Sep. 29, 1905, U. S. Patent Office.

Patent Office, Sep. 30, 1905, Division XXV.

Serial No. 185,475, Paper No. 8.

Filed —— —, 190-.

Room No. 315.

In the Application of Edmund B. Kirby for Separating Tables. Filed December 17, 1903. Serial Number 185,475.

We hereby appoint the firm of Thurston, Bates & Woodward, (consisting of E. L. Thurston, Albert H. Bates and J. M. Woodward)

Registration Number 7162, as our substitute attorneys, with such full powers to act as we ourselves possess.

THURSTON & BATES.

Mail Room,
Feb. 3, 1906,
U. S. Patent Office.

Patent Office,
Feb. 6, 1906,
Division XXV.

Serial No. 185,475, Paper No. 9.

Room No. 315.

In the Application of Edmund B. Kirby for Separating Tanks. Filed December 17th, 1903. Serial No. 185,475.

We hereby appoint the firm of Thurston and Woodward, 1228 Citizens Building, Cleveland, Ohio, (consisting of E. L. 2042 Thurston, and J. M. Woodward,) Registration Number 7412, as our substitute attorneys, with such full powers to act as we ourselves possess, revoking the power heretofore granted to Thurston, Bates & Woodward.

THURSTON & BATES.

We consent to the above:

THURSTON, BATES & WOODWARD.

2043

Fig. 1

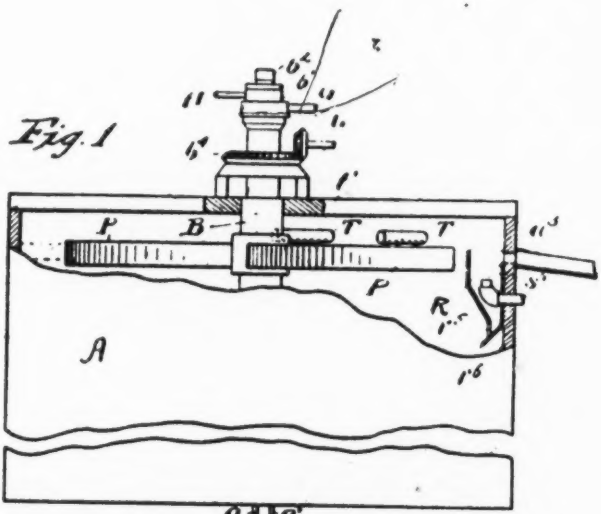
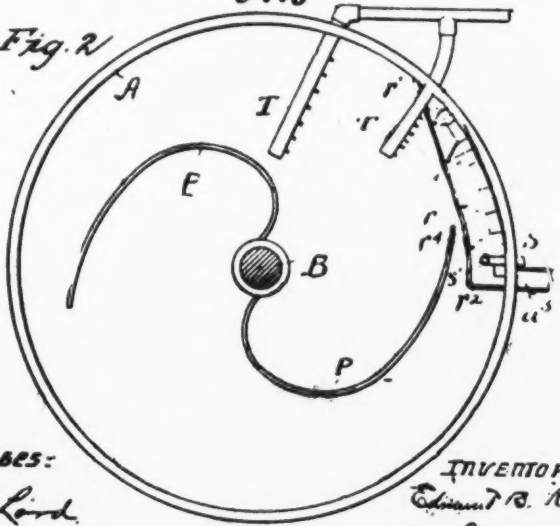


Fig. 2



Witnesses:
A. L. Lord
Bel. V. Brockett

Inventor
Edmund B. Kirby
By Thurston & Dabney
Attorneys

2044 Mail Room,
Apr. 21, 1906,
U. S. Patent Office.

Room 315.

Cleveland, Ohio, April 19, 1906.

Commissioner of Patents, Washington, D. C.

SIR: In the matter of the application of Edmund B. Kirby, for Separating Tank, filed December 17, 1903, Serial No. 185,475, last Office action April 27, 1905.

It is requested that the Chief Draftsman correct the drawing as indicated by the lines in red ink in the accompanying print.

Respectfully,

EDMUND B. KIRBY,
By THURSTON & WOODWARD,
His Attorneys.

2045 Mail Room,
April 25, 1906,
U. S. Patent Office.

Patent Office,
Apr. 26, 1906,
Division XXV.

Serial No. 185,475, Paper No. 10.

Room 315.

Cleveland, O., April 23, 1906.

Hon Commissioner of Patents, Washington, D. C.

SIR: In the matter of the application of Edmund B. Kirby, for Separating Tanks, filed December 17, 1903, Serial No. 185,475, last Office Action April 27, 1905.

In conformance with the requirement of the Examiner, we have, in a separate letter, requested the Patent Office Draftsman to correct the drawings so as to indicate the structure of the settling compartment.

It is believed that the correction of the drawings places the case in condition for allowance.

Respectfully submitted,

EDMUND B. KIRBY,
By THURSTON & WOODWARD,
His Attorneys.

2046 S. M.

Serial No. 185,475.

Issue Division.

All communications should be addressed to "The Commissioner of Patents, Washington, D. C."

United States Patent Office,

Department of the Interior.

Washington, D. C., May 24, 1906.

Edmund B. Kirby, c/o Thurston & Woodward, 1028 Soc. for Savs. Bldgs., Cleveland, Ohio.

SIR: Your application for a patent for an improvement in Separating Tanks, filed Dec. 17, 1903, has been examined and allowed.

The final fee, Twenty Dollars, must be paid, and the Letters Patent bear date as of a date not later than six months from the time of this present notice of allowance.

If the final fee is not paid within that period the patent will be withheld, and your only relief will be by a renewal of the application, with additional fees, under the provisions of Section 4897, Revised Statutes. The office aims to deliver patents upon the day of their date, and on which their term begins to run; but to do this properly applicants will be expected to pay their final fees at least twenty days prior to the conclusion of the six months allowed them by
2047 law. The printing, photolithographing, and engrossing of the several patent parts, preparatory to final signing and sealing, will consume the intervening time, and such work will not be done until after payment of the necessary fees.

When you send the final fee you will also send, distinctly and plainly written, the name of the inventor and title of invention as above given, date of allowance (which is the date of this circular), date of filing, and, if assigned, the names of the assignees.

If you desire to have the patent issue to assignees, an assignment containing a request to that effect, together with the fee for recording the same, must be filed in this office on or before the date of payment of final fee.

After issue of the patent uncertified copies of the drawings and specifications may be purchased at the price of five cents each. The money should accompany the order. Postage stamps will not be received.

Very respectfully,

F. I. ALLEN,
Commissioner of Patents.

In remitting the final fee give the serial number at the head of this notice.

Uncertified checks will not be accepted.

2048 *Certificate of Deposit.*

$20 Received Nov. 24, 1906. S. Chief Clerk, U. S. Patent Office.

November 24, 1906.

Commissioner of Patents, Washington, D. C.

DEAR SIR: In the matter of the application of Edmund B. Kirby for an improvement in Separating Tanks filed December 17, 1903, Serial No. 185,475, allowed May 24, 1906, we hand you herewith as final Government Fee $20.00 in the form of a certificate of deposit.

Yours truly,

THURSTON AND WOODWARD.

2049 2–183.

S. M.

Issue and Gazette Division.

Serial No. 185,475.

All communications should be addressed to "The Commissioner of Patents, Washington, D. C."

Department of the Interior,

United States Patent Office,

Washington, D. C., Nov. 24, 1906.

Edmund B. Kirby, c/o Thurston & Woodward, 1223-1229 Citizens' Bldg., Cleveland, Ohio.

SIR: Your application for a patent for an improvement in Separating Tanks, filed Dec. 17, 1903, has been examined and again allowed.

The final fee, twenty dollars, in the above-entitled case was received Nov. 24, 1906.

Very respectfully,

F. I. ALLEN,
Commissioner of Patents.

[Here follows printed copy of Patent 838,626.]

2050-1 1903.

83. Mills,
Ore and Coal Washers.

Contents.

Print, Apr. 10, 1905.
Application, — papers.
1. Rej., Jan. 20, 1904.
2. Amendment A, Mar. 21, 1904.
3. Rej, Apr. 11, 1904.
4. Amendment, Mar. 24, 1905.
5. Letter, Mar. 29, 1905.
6. Amendment, Apr. 4, 1905.
6½. Letter to draftsman, " " "
7. Letter, Apr. 28, 1905.
8. Sub. P. Atty., Sept 29, 1905.
9. " " " Feb. 3, 1906.
10. Letter to Office, Apr. 25, 1906.
11.
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Title: Improvement in Separating Tanks.

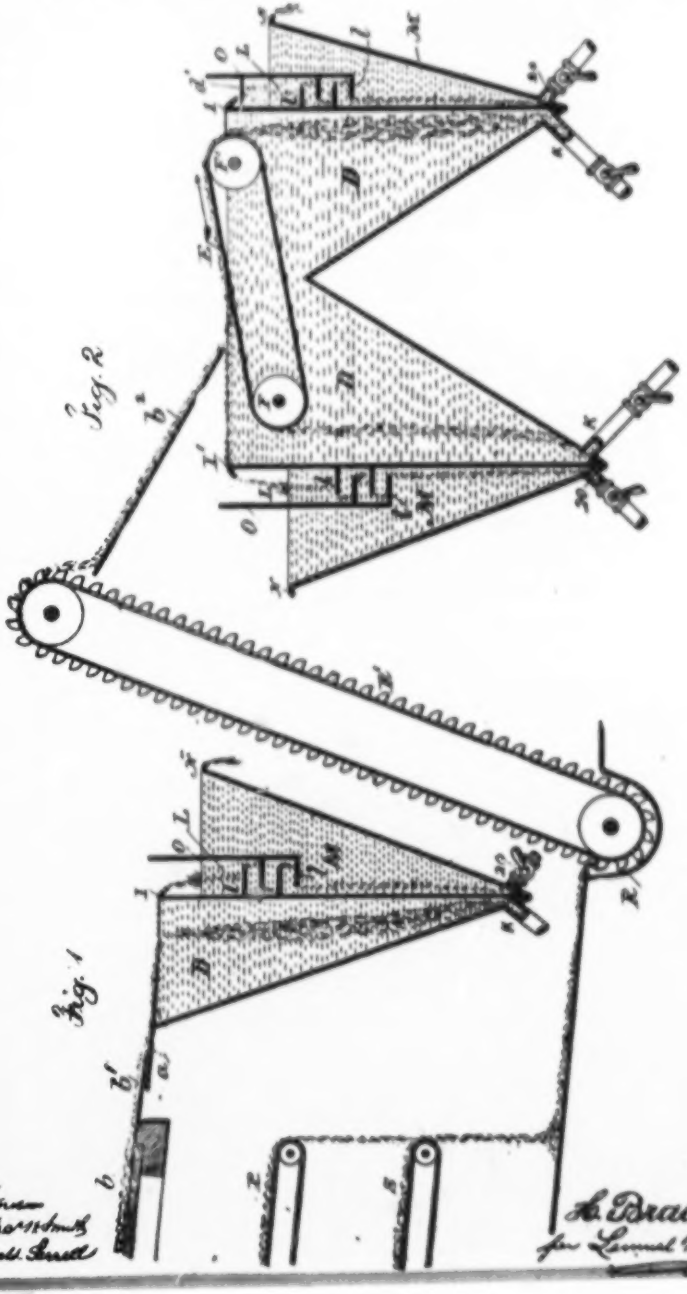
(No Model.) 2 Sheets—Sheet 1.

H. BRADFORD.

METHOD OF SAVING FLOATING MATERIALS IN ORE SEPARATION.

No. 345,951. Patented July 20, 1886.

2052



Witnesses
Chas. H. Smith
Ronald Purcell

Inventor
H. Bradford
per Lemuel W. Serrell

(No Model.) 2 Sheets—Sheet 2

H. BRADFORD.

METHOD OF SAVING FLOATING MATERIALS IN ORE SEPARATION.

No. 345,951. Patented July 20, 1886.

363

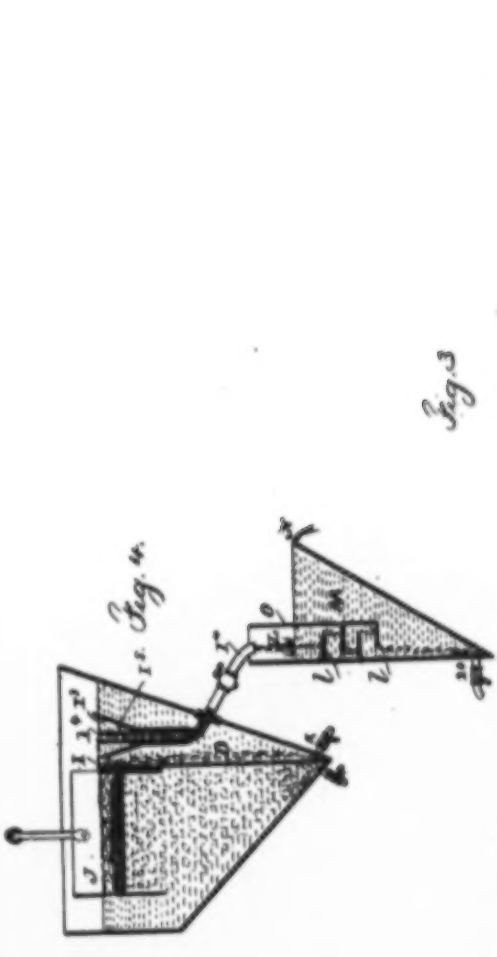


Fig. 4.

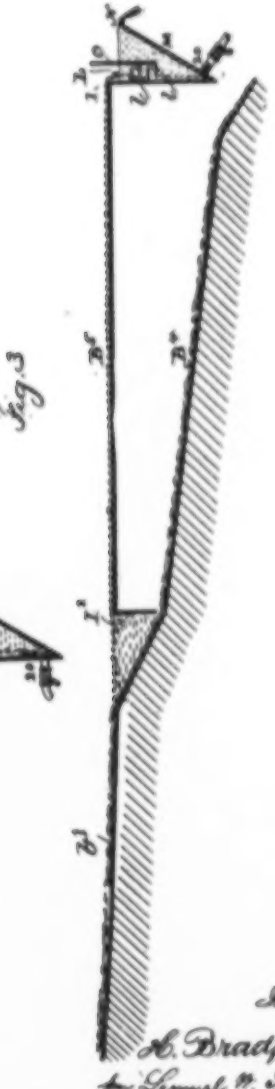


Fig. 3

Witnesses
Chas. H. Smith
Harold Sewell

Inventor
H. Bradford
per Lemuel W. Serrell

UNITED STATES PATENT OFFICE.

HEZEKIAH BRADFORD, OF PHILADELPHIA, PENNSYLVANIA.

METHOD OF SAVING FLOATING MATERIALS IN ORE-SEPARATION.

SPECIFICATION forming part of Letters Patent No. 345,951, dated July 20, 1886.

Application filed June 8, 1885. Serial No. 168,343. (No model.)

To all whom it may concern:

Be it known that I, HEZEKIAH BRADFORD, of Philadelphia, in the State of Pennsylvania, have invented an Improvement in Methods of Saving Floating Materials in Ore-Separation, of which the following is a specification.

Almost all metallic ores—coal and other substances—when pulverized, contain a greater or less proportion of particles of ore or metal that will, even if pulverized in water, float on the surface of the water, and the finer the substances are pulverized the greater the proportion of floating particles. These floating particles appear to possess some peculiar quality which repels the water from their surfaces, especially when such particles are exposed, even momentarily, to atmospheric air, and when such exposure takes place the water is repelled from a sufficient portion of their surfaces to cause such particles to float off on the surface of the waste water from the other particles that sink in the water.

In concentrating ores they should be pulverized fine enough to liberate the metallic particles and the particles of native metals from their gangue. They are then, or should be, sized with screens. The larger sizes are, or should be, concentrated in jigs. The finer sizes are, or should be, concentrated by concussion-tables similar to the "Rittinger table," or by some of the various vanning-machines.

In amalgamating ores the quicksilver will not act on the base metallic ores; neither will it act on the particles of native metal unless the particles are brought in contact with the quicksilver, and consequently all the particles that float off over the amalgamating-pan are lost.

In the concentration of coal from slate as heretofore practiced a considerable proportion of coal, iron pyrites, and some slate will float off and be lost, and there are many other substances which while being concentrated or washed in water have heretofore floated off and been lost.

In the drawings, Figure 1 is a section representing my improvement as applied to the separator known as the "Rittinger table." Fig. 2 represents the improvement as applied to an ore-separator of the class known as the "Frue vanner." Fig. 3 represents the improvement as adapted to a trough or similar delivery device through which the tailings pass, and Fig. 4 represents the improvement as adapted to the tailings from a jig.

My present invention consists in a method of saving floating materials in ore-separation by passing such floating materials along upon the surface of the water, with but little agitation of the water, thus preventing such materials from subsiding, and then causing the water and floating materials to plunge or fall into a water-receptacle, and retaining said floating materials in said receptacle until they lose their floating power and sink. To accomplish this I attach to the end of the table *b* a metal plate, *b'*, on a level with the table and of the same descent, and fit it so evenly as to cause no ripple in the water as it passes from the table to the plate. This plate is wide enough to catch all the tailings, the waste water, and the floating material as these substances leave the lower end of the table, and catch none of the concentrations, and as the line where the concentrations and tailings meet on the table changes back and forth this plate must be so attached to the end of the table that it can be moved back and forth as this line changes on the table. This plate *b'* must be attached also as nearly parallel as possible with the line of motion of the table.

Under the plate *b'*, and as close to it as possible, I provide a stationary metal plate, *a*, which receives the water, the tailings, and the floating material without ripple, and conveys the same to the top of the water in tank D. This plate *a* is preferably a little more inclined than the plate *b'*, as it has no motion. Both plates should have just descent enough to deliver the substances upon the top of the water in tank D with as little force as possible, and the plate *a* should touch the top of the water, so that the substances will not plunge under the water of the tank D or make any unnecessary ripple; nor should said plate *a* dip under the water, as that would cause an eddy in the current on the top of the water by the discharge of the substances from plates *b'* and *a*, and this eddy, by detaining the floating particles, would cause some of them to sink

among the tailings. As soon as these substances strike the water of the tank D, the tailings will immediately sink to the bottom of the tank, while the floating particles will pass, with a part of the waste water, over the overflow I of tank D into a receptacle, L, in tank M, with a fall sufficient to plunge the floating particles under water. This receptacle L should be small enough so that the whole surface of the water therein will be constantly acted upon by the plunging water, in order to thoroughly wet the floating particles, some of which will rise many times to the top of the water before they get wet enough to sink; and to insure the fall of the water, so as to cover the whole surface of the receptacle L, a perforated plate, d', may be used, as shown in Fig. 2, with holes enough and large enough to shower the water over the whole of this receptacle L. In this receptacle L, I provide a series of shelves, l, to break the force of the plunging water, so that when it passes down below the lower shelf with the metallic particles it will produce no agitation in the main body of the water in the tank M, and the particles that floated are so thoroughly wet as to sink below the bottom shelf, and to continue to sink until they reach the bottom of tank M, and they will not float again without exposure to atmospheric air. The water will pass off at the overflow N of tank M free from floating material. Where there is not fall enough from the end of table b or the end of vanners P and S, or where plates like b' could not be attached for conveying the tailings, the waste water, and the floating materials directly to the tank D without ripple, the substances must be conducted to trough R, from which these substances must be raised by an elevator, R', high enough to be deposited in the trough or incline b^3, which will deliver them upon the belt E, a portion of which is immersed in water in tank D, and the upward motion of this belt will elevate these tailings and floating materials out of the water, so that atmospheric air will come in contact with the tailings. When the belt delivers these substances again to the water, the tailings will immediately sink in the water to the bottom of the tank D, while the particles that repel the water will float and pass off over the overflow I into a receptacle, L, of tank M, similar to that shown in Fig. 1, where all the floating particles will become wet enough to sink, and the waste water will pass away at the overflow N. All the particles that float on the top of the water, as the substances are deposited in the water on the belt E, will float out at the overflow I' into a tank similar to M, where these particles will sink and the waste water pass off free from floating material. The belt may be made of rubber, like a Frue-vanner belt, with ridges on both edges to prevent the substances from running over the sides of the belt, or it may be made of any other suitable material, but should have ridges at the edges of the belt. The belt should fit the tank closely, so that the floating particles from the lower end of the belt will pass off at the overflow I'. All the tanks should be discharged at the bottom continuously through stop-cocks or other equivalent means. Where the waste-water way has but little descent, I provide a trough, b^3, Fig. 3, at an incline just enough to carry off these substances a sufficient distance to procure, if possible, a depth for the dam I^c of at least twelve inches. The floating particles will pass with a small portion of the waste water to the dam I, and the tailings will pass away at the bottom of the dam with part of the waste water, which will carry off all the tailings.

The dam I, vessel M, and the parts for saving the floating material are similar to those shown in Fig. 1.

Where the ore is too coarse in size to be concentrated on tables, it is generally concentrated in jigs (see J, Fig. 4.) Any particles that float on the water will pass out of the jig J with the tailings at the overflow I. The tailings will sink in the water in the tank D as soon as they pass this overflow, and will be discharged at the bottom of the tank by the pipe and cock K, and the floating material will pass, with a portion of the waste water, into a receptacle, I^1, which is contracted at the bottom to a size just sufficient to form a pocket, I^3, that will hold an upright pipe, I^4, in the center of this receptacle, which pipe ought to be of sufficient size to carry off a part of the waste water and all of the floating material from the jig. The bottom of the pocket is extended through the side of the jig, and has a stop-cock at the end, where the waste water and the floating material should be continuously discharged into a receptacle, L, in the tank M. The conical receptacle I^1 should have a flat side toward the overflow, extending the whole length of the overflow of the jig, and should be placed just far enough, but no farther, from the overflow I to allow all the tailings to settle before the waste water and floating material reach the receptacle I^1. The reason for this is, that some of the floating particles have only a little floating capacity, and many will sink before they float far. When they once float over the receptacle I^1 with part of the waste water, the current caused by the suction of the discharge-pipe I^4 in the center of the receptacle I^1 will draw the floating particles, and the waste water and the floating material are discharged into the receptacle L in the tank M, where the floating material will be saved, as before described. Any particles that sink in the receptacle I^1 before they reach the pipe I^4 can be discharged from the receptacle by raising the pipe I^4 from the pocket.

All the tanks are discharged at the bottom through stop-cocks, which should be so regulated as to discharge just water enough to carry out their respective deposits.

If it should be desirable to again expose the tailings from tank D and trough B' to the action of atmospheric air, they can be conducted in any convenient way to a trough, like R, elevated by an elevator, like R', and delivered onto a belt, like E, in tank D, where such particles as would float could be saved.

The shelves in receptacle L, instead of being horizontal, may be placed at an angle sufficient to discharge the particles of floating material as fast as such particles settle on such slanting shelves—say at an angle of seventy-five degrees—which will prevent agitation in the water in the main body of the tank nearly or quite as well as the horizontal shelves, taking care to have ample room for the water to pass away between the shelves.

In depositing the water, tailings, and floating material on the belt E, a small portion of fine tailings may, in the agitation caused by such deposit, pass off into tank D at the lower end of belt. Any such tailings will sink in the tank and pass off at stop-cock K.

This improvement is available with ores or tailings that are either in a wet or dry condition. When such materials are in a dry condition, they are to be scattered upon the water by sifting or otherwise near the surface, so as to fall upon the water with but little concussion. A part of the metallic portions will float, and most of the earthy portions will absorb moisture and sink. I therefore do not limit myself to any particular manner of supplying the material to be operated upon, or of causing the particles that are to be separated to float.

I do not claim a separating device in which the water and tailings from a stamp or other reducing-machine pass through a pipe to a vessel in which the particles of ore are to be gathered as they float, because in so doing the materials that may have floated are carried down under water and considerable sinks. By my improvement any particles that come to the surface are kept up, so that they may not sink until they reach the place where they are saved.

I do not herein lay claim to the means employed for the conduct of the method, but reserve the right to apply for a separate patent thereon.

I claim as my invention—

The method herein specified of saving floating materials in ore-separation, consisting in passing the water and floating materials along in an open unobstructed sheet from the table or separating-machine with but little agitation of the water, thus preventing such materials from being carried beneath the surface and subsiding, then causing the water and floating materials to plunge or fall into a water-receptacle, and then retaining said floating materials in said receptacle until they lose their floating power and sink, substantially as specified.

Signed by me this 20th day of June, A. D. 1885.

HEZEKIAH BRADFORD.

Witnesses.
GEO. T. PINCKNEY,
WALLACE L. SERRELL.

UNITED STATES PATENT OFFICE.

CARRIE J. EVERSON, OF CHICAGO, ILLINOIS.

PROCESS OF CONCENTRATING ORES.

SPECIFICATION forming part of Letters Patent No. 348,157, dated August 24, 1886.

Application filed August 29, 1885. Serial No. 175,665. (Specimens.)

To all whom it may concern:

Be it known that I, CARRIE J. EVERSON, of Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Processes of Concentrating Ores, and I do hereby declare that the following is a full, clear, and exact description thereof.

The discovery which forms the basis of my invention is that metals and metallic substances in a comminuted state will unite with compounds of fats or oils and acids, and that such compounds will not unite with comminuted quartz or other rocky gangue. The essential feature of the method which constitutes my invention, therefore, consists in commingling with pulverized ore a fat or an oil, either animal, mineral, or vegetable, or a fatty constituent or acid of an animal or vegetable fat or oil, or any constituent of a mineral oil, together with an acid, either mineral or vegetable, or a soluble neutral or acid salt, for the purpose of effecting a union of the free metal or metallic portion of the ore with such admixed material, whereby the same may be retained in the subsequent separation of the quartz or other rock therefrom by washing or other suitable means.

The invention is more specially applicable to the treatment of ores in which the metal or metallic portion is mixed with quartz or other rock as distinguished from the mixture of mineral with clay, though it is applicable to ores containing alumina, together with quartz or other rock, to the extent of permitting the removal of the silica or sand.

The operation of concentration as a whole, or in its practical form as applied to the separation of rocky mineral ores, involves the reduction of the quartz or other rock containing the mineral to a powder, the addition thereto of the fat or oil and acid or salt, and the subsequent removal of the gangue.

If my invention is inapplicable to any particular rocky ores or class or classes of rocky ores, or to the concentration of any particular metal, such limitations are not now known to me. Its commercial value, however, will probably be restricted to its use in connection with ores bearing the precious metals, such as gold, silver, and copper.

Among the ores upon which I have operated successfully by means of my invention are the following: Ores containing native gold and silver, kerargyrite, argentite, argentiferous galena, and a variety of double and otherwise compound sulphides of silver, with copper, antimony, arsenic, and other base-metal sulphides. I have also operated successfully upon pyritic ores, white, yellow, green, and intermediate shades, having variable constituents of iron, copper, arsenic, and sulphur, and mostly auriferous, and having variable proportions of such constituents. I have also operated successfully upon ores containing tellurides of gold, silver, and lead, and others containing the oxides and carbonates of copper and the carbonate of lead. All the metals or metallic mineral portions of these ores are acted upon by the admixture described, in such manner as to permit the rocky gangue to be removed by a washing process, after which the several metals may be separated by the usual means.

In putting my invention into practice any fat or oil, and any acid, either mineral or vegetable, or any soluble neutral or acid salt, or any compound of fats and oils with appropriate acids, may probably be successfully employed, at least such is the case with all of these agents with which I have so far experimented. I have used petroleum and one of its several constituents—namely, paraffine-oils—also tallow, (melted,) lard, lard-oil, red-oil, (impure oleic acid,) cotton-seed oil, castor-oil, sperm-oil, and linseed-oil, and some combinations of these with each other. The acids which I have employed are sulphuric, hydrochloric, nitric, phosphoric, acetic, oxalic, tannic, and gallic. I have also used the following salts, to wit: the sulphates and chlorides of sodium, zinc, and copper, and the double sulphate of potash and alumina. The selection of the appropriate agents will, however, be largely determined in the practical working of my invention by the consideration of economy, which will obviously exclude the greater number of those above enumerated. A reasonably cheap and practicable use of my invention will be as follows, the quantity named being suitable for laboratory use and the character of the ore specified being substantially that of an ore upon which I have successfully operated by the preparation and in the manner hereinafter described.

Take an ore assaying twelve ounces per ton in silver and containing forty eight per cent. silica, 6.3 per cent. zinc, 1.5 per cent. copper, fifteen per cent. iron and aluminium, 6.5 per cent. lead, 14.18 per cent. sulphur, 7.19 per cent. arsenic. Of this ore take four (4) ounces by weight in pulverulent form, prepare a mixture containing sulphuric acid, cotton seed oil, and water, in all about twelve fluid drams, of which ten drams are of water and about two drams are acid and oil in the proportions of fifteen parts of the oil and two parts of the acid by measure. In making this fluid mixture the acid and oil are first mixed with each other, the acid being added to the oil very gradually, so that the temperature will not rise above 120° Fahrenheit. The stirring in of the acid should be thorough, as it tends at first to gravitate to the bottom. After a few hours, in a summer temperature, the mixture will be ready for use, and, preferably, in such a temperature should not be prepared long before using, though if it should have stood long enough to solidify it should be gently heated before adding the water thereto. In winter or in air tight vessels it may be kept for a number of weeks or even longer, and then rendered fit for mixing with water by heating gently when required for use. The water may be advantageously added in installments of about three equal parts, and the mixture stirred after each addition of water until it stiffens. After stirring in the entire quantity of water the compound is added to the ore, the proportions of ore and compound being chosen with a view to producing a stiff mass after the materials have been incorporated, such proportions being therefore variable in different cases with this end in view. The stirring or incorporation of the ore with the liquid should of course be thorough for the purpose of bringing the mineral into contact with the oil and acid as completely as possible, and after such incorporation the mass is then in condition for the washing out of the quartz by the action of water which will be applied to the mass in sufficient quantities for this purpose. The washing should promptly follow the mixing, and in this operation the mass be opened out or broken up and thoroughly stirred in the water, in order that the sand or quartz may be freed and carried away. In treating so small a bulk as above specified the mass may be squeezed repeatedly in the hand in a basin of water, the substance so manipulated being expressed between the fingers each time it is squeezed, and thus made to expose new surfaces to the water from which the sand will be detached, so as to fall to the bottom of the basin. In practice upon large masses any vessel having an outlet or outlets at its bottom for the escape of the water and sand will be suitable for this operation of washing, and mechanical means will of course be employed to break up the mass. The concentrated mineral will accumulate in a pasty mass or lump or lumps and will contain the metallic portion of the ore, together with the hydrated oil and acid, which latter may be removed by heating and afterward roasting, or by other suitable means. The use of petroleum or of a constituent thereof, either by itself or in combination with tallow, (heated,) cotton seed oil, or other fat or oil, will be even less expensive.

When petroleum or a constituent thereof is used the oil should desirably be first mixed with the ore, then water added containing a suitable amount of free acid or a soluble neutral or acid salt, the quantity of water being ample for the washing-out operation, which is to follow, and the quantity of acid sufficient to cut the sand away from the otherwise cohering mass. In the case of petroleum or its constituent, parafline-oil, one or two fluid drams of acid to one gallon of water is sufficient for this purpose. The petroleum which I have used was 30° Baumé, and I have found three fluid drams of oil abundant for properly moistening two ounces of heavy ore, or in the ratio of about a barrel of oil to the ton of ore, the amount being, of course, variable with the relative bulkiness of the ore.

In the use of petroleum, or of a liquid constituent thereof, like paraffine oil, the condition of the concentrated mass is more liquid than when a vegetable or an animal oil or a fatty constituent thereof is used, and a somewhat different means or method should be employed for removing the sand. In practice, the concentrate, after thorough agitation of the mass and detachment of the sand, will in this case be preferably removed by means of a constant overflow of water from a washing-out vessel, by which overflow the concentrate will be floated off. Devices and methods now well known in wet separation of ores will be suited to this part of the operation, bearing in mind that the sand and mineral are merely transposed or their relative positions are reversed, because the sand is heavier than the mixture of mineral, oil, and acid. A proper selection of devices for this purpose will be apparent to those skilled in the wet separation of ores. After removing the quartz or rock by washing or any suitable means the mineral may be roasted, in which operation the water, if present, will be dispelled, the oil will burn out, and the acid will be decomposed and eliminated, in the case of sulphuric-acid, which will commonly be used, by conversion into sulphurous-acid gas, which passes off. In case fixed oils are used the mass may be allowed to stand until the water has run off. To hasten the operation of removing the water the mass may be heated, say, to about 212° Fahrenheit or less, whereupon the water will generally be promptly freed and may be poured off or it may be evaporated. The operation of smelting is facilitated by the presence of the fat acting simply as a fuel.

The disposition made of the mineral or metal after concentration, whether by roasting and subsequent smelting or by smelting without previous roasting, or otherwise, belongs to the

after treatment and is not material to my present invention.

The proportions in which the acids or salts are added to the oils or fats may vary according to the kind of acid or oil employed, and also according to the kind of ore to be treated; and the manipulation of the substances employed may be varied from that above set forth in either formula given. These matters may be determined in individual cases by the operator; and I do not, therefore, restrict myself to any particular proportions of the substances employed, though I have above indicated proportions of certain acids and oils by one of the other of which practical results may be obtained upon almost all varieties of ores.

It is also not essential to my invention that the acid or salt employed with a vegetable oil be added to the oil before the incorporation of the oil with the ore, as it is entirely practicable, at least in most, and possibly in all, cases, to first mix such oil with the ore and thereafter add the acid, as set forth in the use of petroleum.

I am aware that it has been proposed in a patent to Tunbridge, No. 228,004, dated May 25, 1880, to recover finely comminuted metal held in suspension in water by the use of soap or a saponaceous compound formed by a partial or imperfect blending of an alkali or an alkaline salt with a fat or an oil. The action of the soap or saponaceous compound when diffused through hard water containing the metal in suspension is to form with the lime salt in the water a coagulum in which the particles of metal are enveloped and by which they are held during a subsequent removal of the water. When the water is soft a lime salt must be added to form the coagulum. I disclaim the use of any substance in connection with the fats and oils capable of saponifying them. I also disclaim the method set forth in said Tunbridge patent as being entirely dissimilar to that herein claimed. Said Tunbridge method is stated in said patent to consist "in first depriving the water of as much earthy non-metallic matter as possible," this being effected by any of the ordinary methods in use for that purpose, such as letting it stand until the earthy matter precipitates. My invention, on the other hand, has reference solely to the separation of metal or metallic mineral from earthy non-metallic matter, (rocky gangue,) and not to its subsequent separation from water. In the practice of my method, moreover, the metal or mineral and non-metallic matter (rocky gangue) are together and in the first instance mixed with the fat or oil, and the non-metallic matter is afterward separated from the metal or mineral by the peculiar action of the acid or soluble neutral or acid salt operating in the presence of water to detach the gangue from the mass.

With the understanding that I am not restricted in the matters mentioned, I claim, broadly—

1. In the separation of pulverulent ores containing rocky gangue, the method of treatment herein described, which consists in mixing with such pulverulent ore a fat or an oil or a constituent thereof, an acid or soluble neutral or acid salt, and water, finally breaking up the mass to allow the sand to separate therefrom.

2. The method, substantially as described, of separating metals or metallic minerals from rocky gangues, which consists in mixing a fat or an oil or a constituent thereof with pulverized ore and washing out the gangue with water containing an acid or a soluble neutral or acid salt.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

CARRIE J. EVERSON.

Witnesses:
M. E. DAYTON,
G. F. LANAGHEN

(No Model.)

H. J. WAGNER.

CHURN.

No. 373,113 Patented Nov. 15, 1887.

Fig. 1.

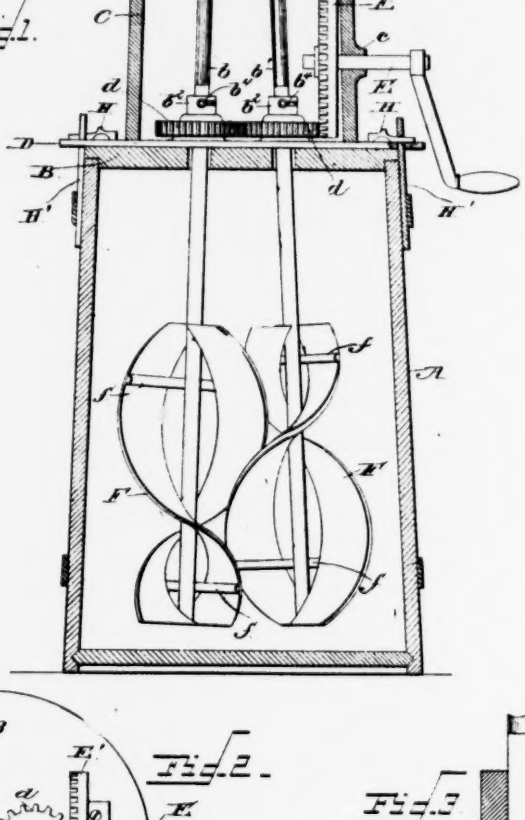


Fig. 2.

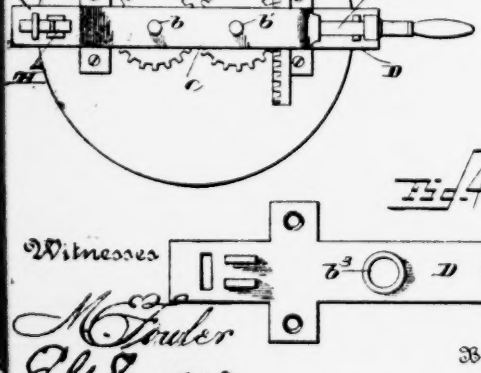


Fig. 3.

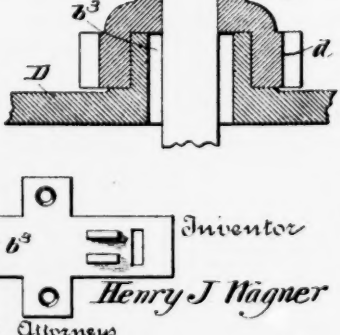


Fig. 4.

Witnesses

M. Fowler

E. G. Siggers

Inventor

Henry J Wagner

By his Attorneys

C. A. Snow & Co

UNITED STATES PATENT OFFICE.

2061

HENRY J. WAGNER, OF DAYTON, MISSOURI.

CHURN.

SPECIFICATION forming part of Letters Patent No. 373,113, dated November 15, 1887.

Application filed June 24, 1887. Serial No. 242,412. (No model.)

To all whom it may concern:

Be it known that I, HENRY J. WAGNER, a citizen of the United States, residing at Dayton, in the county of Cass and State of Missouri, have invented a new and useful Improvement in Churns, of which the following is a specification.

My invention relates to churns; and it consists in the construction and arrangement of parts of the same, which will be more fully set forth hereinafter, and pointed out in the claim.

My present invention relates to an improvement on Patent No. 347,978, granted to me August 24, 1886.

The object of my present invention is to vary the construction of the mechanism shown and described in my patent above mentioned, so as to advantageously provide a churn more positive in its results, cleanly in its operation, simple and effective in its construction, and comparatively inexpensive in its manufacture.

The essential feature of my present invention is the use of suspended dashers devoid of bearing-surface at their lower portions and operated to revolve in reverse directions upon vertically-inclined shafts.

In the accompanying drawings, wherein like letters of reference indicate similar parts in the several views, Figure 1 is a vertical section of my improved churn. Fig. 2 is a top plan view of my improved churn. Fig. 3 is a sectional elevation of a portion of one of the dasher-shafts and its gearing. Fig. 4 is a top plan view of the top bearing-plate.

A indicates the churn-vessel, of suitable size and shape, which is provided with a detachable cover, B, situated on the upper portion of the churn-vessel and having a transversely-arranged metallic plate, D, slotted at its ends to receive the upwardly-projecting spring-plates H', secured to the vessel A and engaged by the locking-bolts H on the ends of the said plate D. The construction as thus described is common to my patented device aforesaid, and I will now proceed to describe my improvement upon said device.

Secured to the cover B is a U-shaped bracket, C, closed at its upper side, and at its ends being firmly secured to said cover in any suitable manner. A boss, *c*, is formed in one side of the bracket C, and provides a bearing for a shaft, E, arranged horizontally therein, and having an operating-handle on its outer side; and on its inner end a face-gear, E', is secured, and arranged in a plane at right angles to the plane of the shaft upon which it is mounted, as will be readily understood.

Two shafts, *b b'*, are vertically mounted in the said frame and at a slight incline to the perpendicular, being loosely secured at their upper ends in the top portion of the bracket C, and having bearing in the boxes b^2 b^2, adapted to fit over flanged openings b^3 in the transverse plate D. The boxes b^2 are formed with apertures, through which spring-pins b^4 engage the shafts, the said shafts being thereby retained in a suspended position. The boxes b^2 are integrally formed with horizontally-arranged spurs or gears *d d*, which rest on the top surface of the transverse plate D and are in mesh with each other and with the vertically-arranged wheel E' at all times. The shafts *b b'* pass vertically through the blocks b^2 at an incline to the perpendicular and the gears *d*, and are locked in connection therewith, to suspend the same, as desired, by means of the pins b^4, secured to said boxes b^2, and adapted to engage openings formed in the shafts *b b'*, for securing the said shafts, as hereinbefore set forth.

On the lower ends of each of the shafts *b b'* spirally-arranged dashers F F are secured. These spiral blades are mounted in connection with said shafts *b* and *b'* by means of transversely-arranged arms *f*, which extend outwardly and are secured to the back sides of each of the blades or dashers, having the shafts for their centers in connection with each dasher. As seen in Fig. 1, the lower ends of the shafts *b b'* do not touch the bottom of the churn body or vessel A, and have no bearing-points at the lower ends thereof, being braced and supported in the cover B and the bracket C, and having a free suspension within the body of the churn, the lower ends of the dashers being farther apart than the upper ends. These dasher-blades and their shafts *b b'* are adapted to have a reverse revolution. This is accomplished by means of the gear E' meshing

with the gears *d*, the gear *d* nearest the gear-wheel E' being revolved in one direction, while the gear *d* on the other side of the first gear *d* is revolved in a reverse direction, as will be readily understood by those skilled in the art.

As hereinbefore set forth, the dasher-blades are formed spirally on two perpendicular shafts turning in opposite directions, giving a slightly angular horizontal circular motion to the dashers, which, crossing each other's circles, the lower ends moving in advance, lift the cream from the bottom, throwing it upward and outward, giving it a semicircular motion, which is continually intercepted in every direction by counter-currents from the oppositely-revolving dashers, causing thorough and equal agitation of the whole mass. In this movement air follows behind and under the blades, and oxygen of the air comes in contact and freely combines with every particle of cream. Thus oxygen combines with sugar of milk, producing lactic acid, which curds the caseine, thus separating it from the butter when the butter-globules are ruptured by agitation. This advantage will be readily appreciable to those skilled in the art of butter-making, and the advantageous action of the spirally-arranged dashers will be readily apparent in respect to the valuable infusion of oxygen.

In the operation of my improved churn no jarring or plunging motion is heard or felt, the operation being in a measure noiseless.

By the arrangement of the driving mechanism and dashers on the cover B, on removing the said cover to introduce hot or cold water for cleaning purposes all the operating parts are removed at one operation, and on replacing the cover the dasher-shafts will be in adjustment and in proper position without the necessity of any connection or manipulation.

The novelty and utility of my improved churn are apparent, and need not be further enlarged upon herein.

Having thus described my invention, I claim—

In a churn, the body A, having its cover or top provided with a plate, D, the latter having openings b^3 therein, and annular upwardly-extending flanges around the said openings, combined with the shafts *b*, carrying the dashers, the lower ends of the dasher-shafts being entirely disconnected from the body, the upper ends of the shafts being passed through the openings b^3, the gears *d*, recessed in the under side to fit over the flanges of the openings b^3 and turn around the same, said gears being separate from the shafts, boxes b^5, formed integral with the gears, a spring locking-pin, b^4, carried by the boxes to lock the boxes and gears to the shafts, a bracket, C, above the cover to receive the upper ends of the shafts *b*, and the gears *d* meshing with each other and the gear E' with driving-shaft E, for the purpose set forth.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in presence of two witnesses.

HENRY J. WAGNER.

Witnesses:

LUCY M. WAGNER,

R. D. RAMEY.

(No Model.) 3 Sheets—Sheet 1.

E. A. HOCKLEY.

ORE SLIMER.

2064

No. 466,753. Patented Jan. 5, 1892.

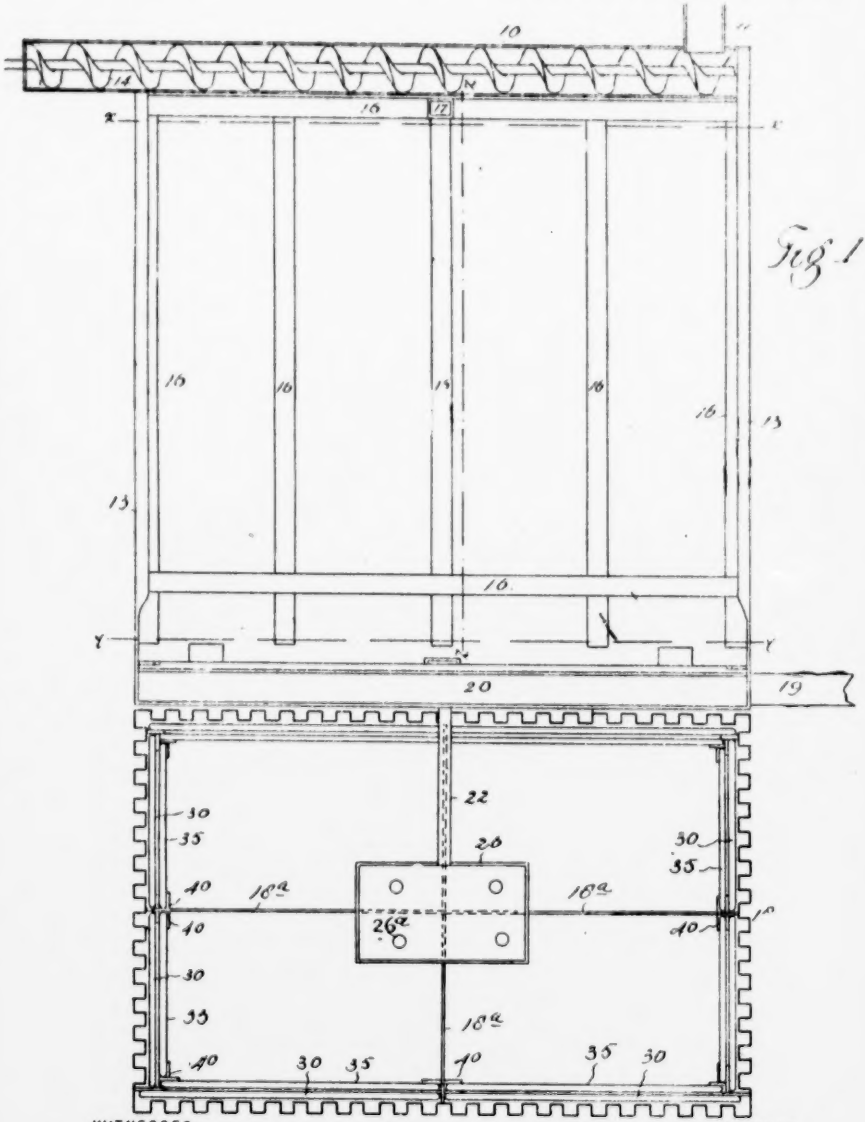


Fig. 1

WITNESSES:
G. J. Rollancet
Wm. McConnell

INVENTOR
Edgar A. Hockley
BY
A. J. O'Brien
AT

(No Model.) 3 Sheets—Sheet 2.

E. A. HOCKLEY.

ORE SLIMER.

No. 466,753. Patented Jan. 5, 1892.

Fig. 2

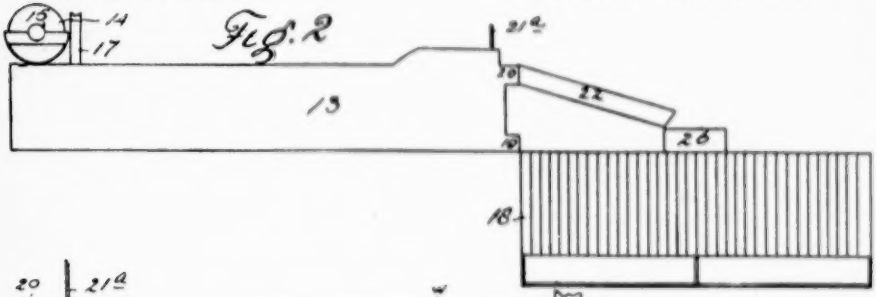


Fig. 6

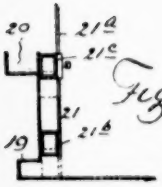


Fig. 3

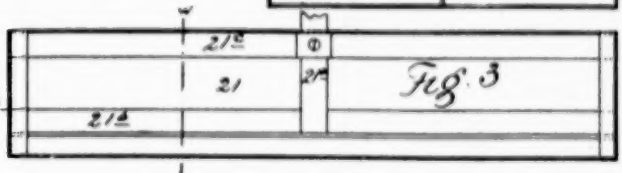


Fig. 4

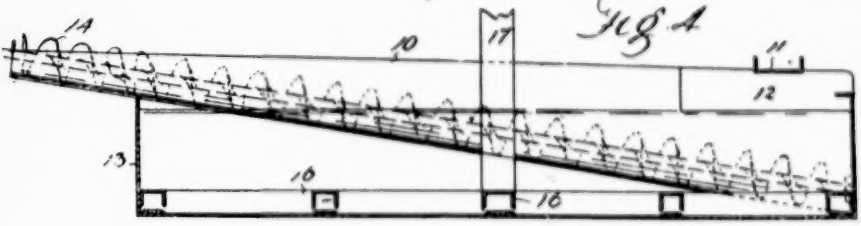


Fig. 5

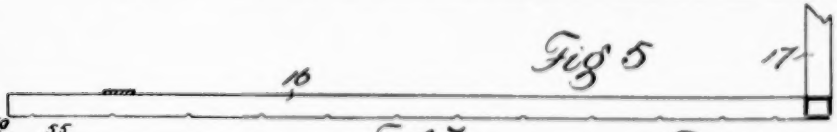


Fig. 7

Fig. 8

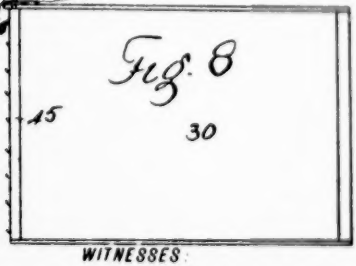


Fig. 9

Fig. 10

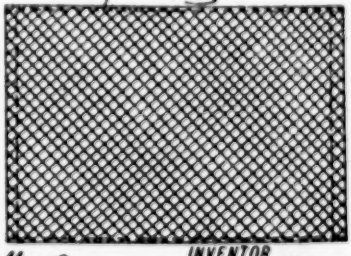


Fig. 11

WITNESSES:

Louis R. Wilgus

Wm. McConnell

INVENTOR

Edgar A. Hockley.

BY

A. J. O'Brien

ATTORNEY.

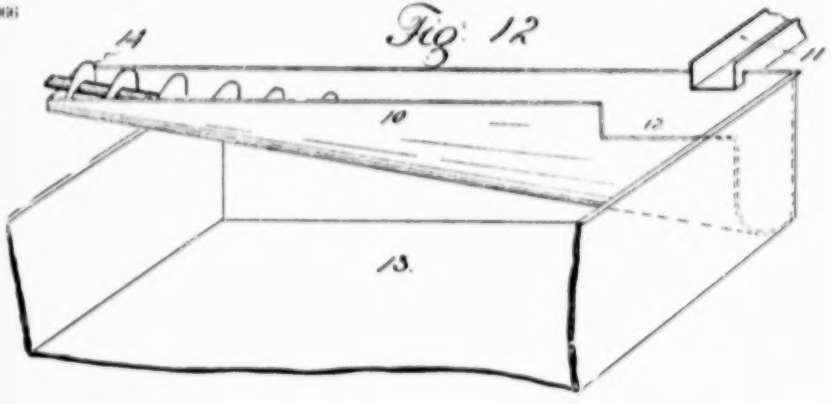
(No Model.) 3 Sheets—Sheet 3

E. A. HOCKLEY

ORE SLIMER.

No. 466,753 Patented Jan. 5, 1892.

Fig. 12



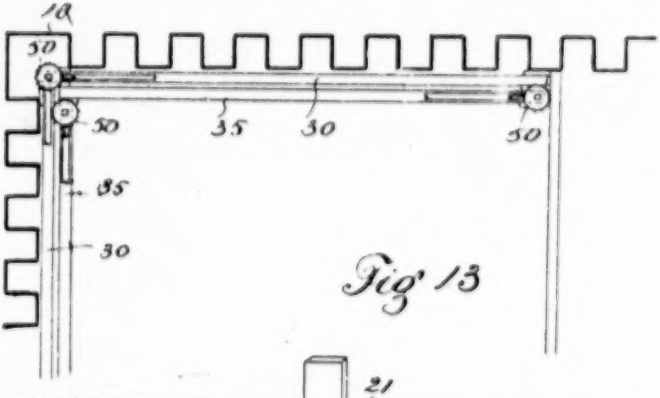


Fig. 13

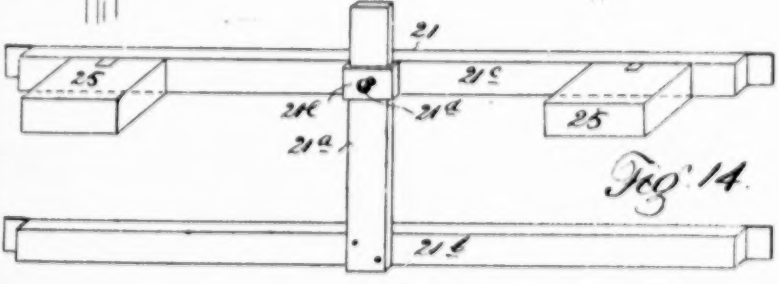


Fig. 14.

Witnesses
C. J. Rolander
Wm. M. Connell

Inventor
Edgar A. Hockley
By his Attorney
A. J. O'Brien

77—Rec.

UNITED STATES PATENT OFFICE.

EDGAR A. HOCKLEY, OF OURAY, COLORADO.

ORE-SLIMER.

SPECIFICATION forming part of Letters Patent No. 466,753, dated January 5, 1892.

Application filed May 19, 1891. Serial No. 393,346. (No model.)

To all whom it may concern:

Be it known that I, EDGAR A. HOCKLEY, a citizen of the United States of America, residing at Ouray, in the county of Ouray and State of Colorado, have invented certain new and useful Improvements in Ore-Slimers; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

My invention relates to a novel form and construction of mechanism for treating ores, and is designed to save the float mineral, usually called "slimes" and sometimes termed "flour" gold and silver. Whichever term may be employed the meaning is the same to practical miners and to those skilled in the art to which this invention appertains, since these terms are applied to that portion of the mineral which is too light to be saved by the ordinary gravity processes, which depend upon the greater specific gravity of the mineral, which causes the same to settle and separate from the gangue or lighter portion of the material. In all classes of ore there is more or less of this light flour or float mineral, which is held in suspension by the water, while in some kinds of ore this class of mineral amounts to a very large proportion of the value, which is therefore ordinarily lost or carried to the dump with the so-called "tailings."

The object of this invention therefore is to save this light mineral either by the original treatment of the ore or by retreating the tailings which have passed through other machines.

The principle of the invention is to aid or increase the natural floating tendency or buoyant condition of the mineral particles, whereby the valuable portion is made to float, while the gangue, which is heavier, settles, thus effecting the separation.

My improved mechanism consists of a pulp-box, a separator, and a filtering-tank. The material to be treated is first discharged into the pulp-box, which catches the greater part of the gangue, and is provided with a screw conveyer for removing the same as fast as it settles, the lighter and valuable portion of the mineral passing thence into the separator, into the bottom of which is forced air, steam, water, or other suitable material, producing such an agitation at the bottom as will cause the mineral to float after first separating or washing it from the gangue, when it passes into a filtering-tank, in which the water is drawn off by suitable means, leaving the mineral. This mechanism will be better understood by reference to the accompanying drawings, in which is illustrated an embodiment of the invention.

In the drawings, Figure 1 is a top or plan view of the mechanism; Fig. 2, a side view or elevation of the same; Fig. 3, a section on the line *y y*, Fig. 1; Fig. 4, a section on the line *x x*, Fig. 1; Fig. 5, a section on the line *z z*, Fig. 1; Fig. 6, a section on the line *w w*, Fig. 3; Figs. 7 and 8, a top and side view, respectively, of the outer filter; and Fig. 9 a section of the same. Figs. 10 and 11 are a side view and a section, respectively, of the inner filter. Fig. 12 is a perspective view of the pulp-box, showing its connection with the separator-tank, which is partially broken away. Fig. 13 is a top fragmentary view, on an enlarged scale, of the filtering-tank, showing the filtering-walls and the rollers to which they are attached. Fig. 14 is a perspective view of the gate which controls the discharge of the material from the separating-tank.

In the views, wherein similar reference-characters designate corresponding parts or elements of the mechanism, let the numeral 10 designate the pulp-box into which the material to be treated is discharged through chute or spout 11. Enough water is discharged into the box 10 with the ore to float the light and valuable portion of the same, which float material or scum passes through a suitable opening 12 into the separating-tank 13, while the gangue or worthless portion passes to the bottom of the box 10, which is provided with an inclined conveying Archimedean screw 14 for removing the gangue from this box. The bottom of this box is inclined correspondingly with the inclination of the screw. The lower end of this screw is journaled in the receiving extremity of the box, whence the gangue is carried upward the entire length thereof, the inclination of this screw and the bottom

of the box being such that the gangue is above the water-level before it is discharged therefrom. The upper extremity of the screw shaft is journaled in a suitable support and is provided with a pulley 15, by means of which motion may be communicated to the screw from any suitable motor. The screw being in motion, the material in box 10 is kept in a state of continuous agitation, so that as the gangue passes upward toward the discharge extremity of the box the float mineral is washed therefrom and rises to the top in a scum, which passes thence to the separator, as before stated. The size and location of the screw are such that its threads reach close to the sides and bottom of the box, by which it is enabled to remove the material very clean from the box. A considerable portion of the gangue which is more closely associated with the mineral will find its way to the separator, which consists of a tank of any desired capacity, preferably located contiguous to the pulp-box. In the bottom of this separator is located a series of perforated tubes or conduits 16, all communicating with each other and forming in effect one continuous perforated conduit. One branch of this conduit is in communication with a stand-pipe or upright tube 17, through which air, water, steam, &c., may be forced into tubes 16 and thence into the bottom of the tank for the purpose of agitation, whereby the light mineral is washed or separated from the heavier gangue and an increased upward or buoyant tendency given said mineral, keeping the same upon the surface of the water until discharged into the filtering-tank 18, hereinafter described. At the bottom of the discharge end or sides of the tank is located the lower trough 19 for carrying away the gangue which settles in the bottom of the tank and the upper trough 20, into which the float mineral passes, which collects in the form of a scum upon the surface of the water. The discharge into the troughs 19 and 20 is controlled by the gate 21, consisting of a stem or standard 21^a, centrally located, a lower valve 21^b, rigidly secured to the stem, and an upper valve 21^c, adjustable thereon by means of a set-screw 21^d, which passes through a metal strap 21^e, secured to the valve and through which the stem passes. The valves are simply cross bars or slats centrally connected with the stem and having their extremities guided in grooved ways 40, formed in the sides of the tank. The gate is also provided with one or more floats 25, preferably two, as shown in the drawings. The floats are secured to the upper or adjustable valve in any suitable manner and are designed to rest upon the surface of the water and to regulate the gate automatically and maintain a uniform quantity of water in the separating-tank. For instance, when the proper amount of water is in the tank valve 21^c, with its floats, is set at the proper height—that is, with the floats resting upon the surface of the water—valve 21^b being partly opened or sufficiently so to carry off the surplus water supply, or that which enters with the material treated. Then if the water-supply is increased the floats will rise and increase the opening below valve 21^b, so as to carry away this increased or excessive supply, while as soon as the supply is diminished the floats lower and partially close valve 21^b. It will thus be seen that this gate is capable of such adjustment that the proper level of the water in the separating-tank may be automatically maintained.

The water and gangue passing through trough 19 may, if desired, be carried or drawn off into any suitable receptacle, whereby they may be allowed to settle in the ordinary way, while the floats or slimes passing into trough 20 are carried by a conduit 22 to the filtering-tank 18. As shown in the drawings, this tank is divided into four compartments by suitable partitions 18^a, which at their intersections in the center of the tank support a box or receptacle 26, into which the material is discharged directly from conduit 22. Receptacle 26 is provided with openings 26^a, adapted to distribute its contents equally into the compartments of the filtering-tank. It will be observed that the dividing of this tank into compartments is only for convenience and not an essential feature, since it may consist of a single compartment or a plural number, as may be desired. The outer walls of this tank 18 are corrugated, as shown in the drawings, but may be of any construction adapted to permit the escape of the water after having passed through the inner filtering-walls of the tank. The filtering-walls are double and consist of an outer wall 30 and an inner wall 35. These walls 30 and 35 are preferably formed in sections adapted to slide in grooved ways or guides secured to or formed within the outer walls of the tank. The filtering-walls are constructed in any suitable manner, the outer being the finer mesh. A suitable construction for the inner wall 35 is a sheet of asbestus paper placed between two sheets of wire-cloth. The asbestus forms the filter, while the wire-cloth gives it protection and support. The whole is attached to a skeleton frame of suitable strength and composed of any desired material. The outer wall 30 may be composed of filtering-paper secured between two layers of cloth attached to a suitable frame. This cloth is preferably made stationary at one end of the frame and secured to an adjustable roller at the other end. This roller is provided with hooks, to which the cloth may be secured, while the top of the roller is provided with a small ratchet-wheel 50, the teeth of which are engaged by a pawl or dog 55, secured to the upper stationary cross-bar of the frame. It will thus be seen that by placing a suitable crank upon the upper extremity 60 of the roller and turning the same the tension of the cloth forming part of the filter may be adjusted to suit the purpose or the requirements of the case. It

will thus be seen that by this construction the mineral will be retained in the tank, while the water is allowed to escape In cleaning up a portion of this mineral will be found between the filters. This may, however, be easily removed by raising the inner filter and brushing this mineral out into the tank.

Having thus described my invention, what I claim is—

1. In an ore separator or slimer, the combination, with a receiving-box provided with an inclined screw conveyer, of a separating-tank provided with perforated tubes located in the bottom or lower portion thereof, a stand-pipe connected with said tubes, a bottom discharge-opening for the tank, and a vertically-movable gate automatically regulated by means of floats, whereby said discharge-opening is controlled, substantially as described.

2. A tank provided with filtering-walls supported upon suitable frames provided with rollers, the filtering material being made fast to the frame at one extremity and to the roller at the opposite extremity, whereby its tension may be regulated as desired, the roller being provided with suitable locking mechanism, as set forth.

3. A tank provided with double filtering-walls of unequal mesh, each wall being supported upon a frame provided with an adjusting-roller, to which the filtering material is attached at one end, substantially as described.

4. A tank provided with removable filtering-walls, each wall consisting of a frame provided with a roller, and a strip of suitable filtering material made fast to the frame at one extremity and to the roller at the opposite extremity, whereby the tension of the filter may be regulated at will, as set forth.

5. A separator provided with perforated tubes located in the bottom or lower portion of the tank and communicating with each other, a stand-pipe leading to the tubes, a bottom discharge-opening, and a gate provided with floats, whereby said opening is automatically regulated, substantially as set forth.

6. A filtering-tank provided with outer corrugated walls and inner removable filtering-walls provided with rollers for regulating the tension of the filtering material, as set forth.

7. An ore separator or slimer consisting of a receiving-tank provided with an inclined screw conveyer, a separating-tank provided with perforated pipes located at or near its bottom and a stand-pipe connected therewith, said tank being provided with a top and bottom discharge, a vertically-movable gate provided with valves and floats, whereby the discharge of material from the tank is automatically regulated, and a suitable filtering-tank, the three tanks being arranged and connected substantially as and for the purpose set forth.

In testimony whereof I affix my signature in presence of witnesses.

EDGAR A. HOCKLEY.

Witnesses:
W. H. GUBBERT,
L. C. KINIKIN,
W. B. VANATTA.

(No Model.) 3 Sheets—Sheet 1

A. M. ROUSE.

METHOD OF AND APPARATUS FOR SEPARATING SLIME OR FINES FROM WATER USED IN MILLING ORES.

No. 469,599 Patented Feb. 23, 1892.

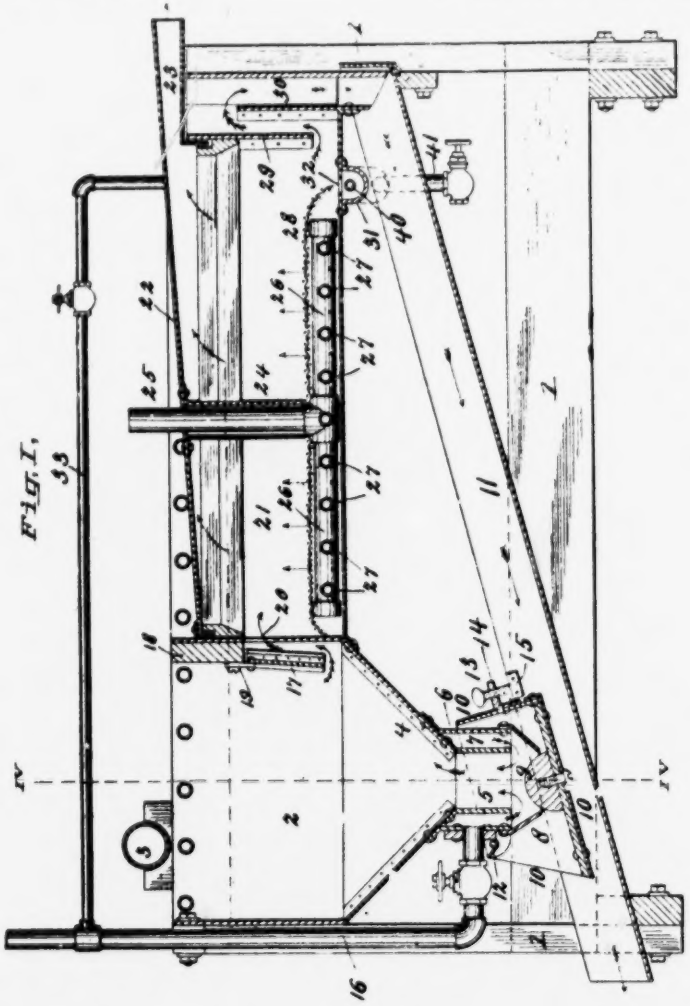


Fig. I.

ATTEST

M. E. Durand
S. Cotton

INVENTOR

Albion M. Rouse
By Wright & Brod
Attys.

(No Model.) 3 Sheets—Sheet 2

A M ROUSE.

METHOD OF AND APPARATUS FOR SEPARATING SLIME OR FINES FROM WATER USED IN MILLING ORES.

No. 469,599. Patented Feb. 23, 1892.

2071

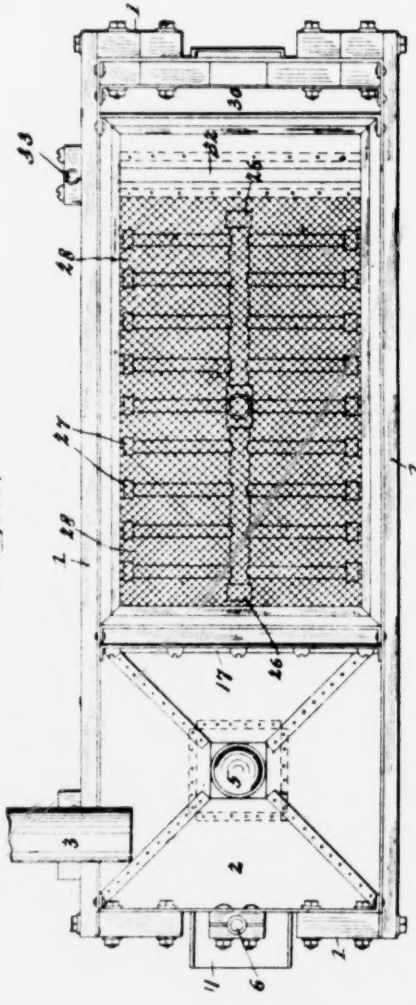


FIG. II.

ATTEST

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(No Model.) 3 Sheets—Sheet 3

A. M. ROUSE.

METHOD OF AND APPARATUS FOR SEPARATING SLIME OR FINES FROM WATER USED IN MILLING ORES.

No. 469,599. Patented Feb. 23, 1892.

Fig. III.

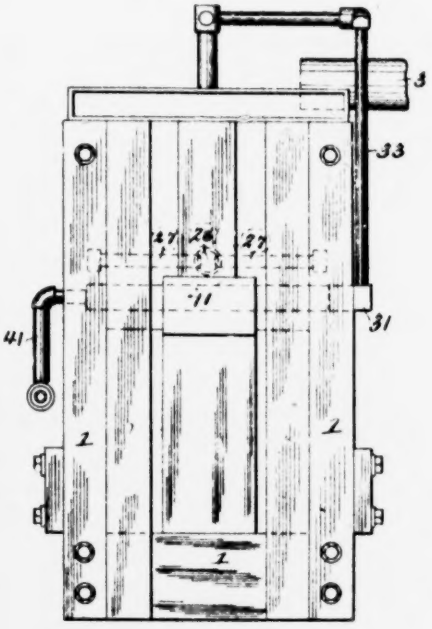
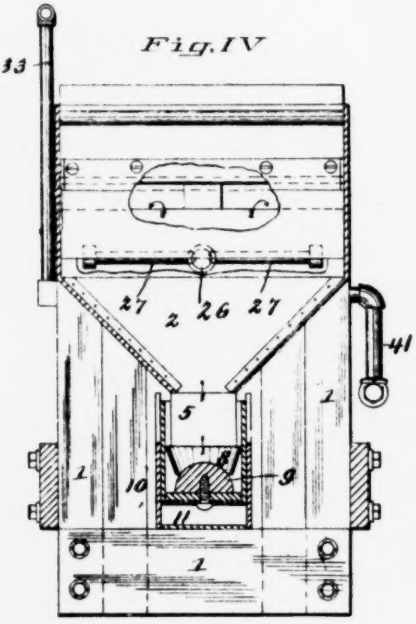


Fig. IV.



ATTEST

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S. Cotton

INVENTOR

Albion M. Rouse

By Knight Bros

Attys

UNITED STATES PATENT OFFICE.

2073

ALBION M. ROUSE, OF BOULDER, COLORADO, ASSIGNOR TO GEORGE R. WILLIAMSON, OF SAME PLACE.

METHOD OF AND APPARATUS FOR SEPARATING SLIME OR FINES FROM WATER USED IN MILLING ORES

SPECIFICATION forming part of Letters Patent No. 469,599, dated February 23, 1892.

Application filed September 29, 1891. Serial No. 407,147. (No model.)

To all whom it may concern:

Be it known that I, ALBION M. ROUSE, of the city of Boulder and county of Boulder, in the State of Colorado, have invented a certain new and useful Improvement in Methods and Apparatus for Separating Slime or Fines from Water Used in Milling Ores, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

My invention relates to an improved method and apparatus for removing or separating slime or fines from water carrying ores; and my invention consists in features of novelty hereinafter fully described, and pointed out in the claims.

Figure I is a vertical longitudinal section of an apparatus embodying my invention. Fig. II is a top or plan view with the cover of the scum-chamber removed. Fig. III is an end view, and Fig. IV is a vertical transverse section taken on line IV IV Fig. I.

I will proceed to describe the apparatus with reference to the drawings, which, with the description of the operation of the apparatus, will explain my improved method.

1 represents a suitable frame.

2 represents a pulp-chamber, into which the pipe 3 discharges the tailings from an ore-mill. This chamber has a funnel-shaped bottom 4, terminating in a neck 5, surrounded by a cylinder or wall 6, forming an annular chamber 7. The lower end of the cylinder or annular wall 6 forms the seat 8 of a valve 9, secured to a housing 10, located in a trough 11 and pivoted to the frame at 12. The valve 9 is moved to or from its seat by a set-screw 13, passing through a lug 14 on the housing and bearing at its lower end against a cross-piece 15 on the trough 11, so that by turning the set-screw the valve may be moved to or from its seat by adjusting the housing on its pivot 12.

16 represents a water-pipe discharging into the chamber 7.

17 represents a yielding gate secured to a cross-piece 18 of the frame 19 and behind which there is an opening 20 in the inner wall of the chamber 2.

21 represents the slime-chamber having a cover 22 with a discharge-spout 23. The cover 22 has a sleeve 24, which extends downward through the chamber 21 and receives the vertical portion 25 of an air-pipe, on the lower end of which are horizontal pipes 26, having a number of perforated lateral pipes 27.

28 represents a perforated metal or wire mesh screen located over the pipes 26 27.

29 represents a deflecting-plate at the inner end of the chamber 21 and behind which the waste water passes into a spout 30, which discharges into a trough 11.

31 represents a trough on the under side of the bottom of the chamber 21 and which communicates with the chamber through an opening 32.

33 represents a pipe forming a communication between the pipe 16 and the trough 31, through which water is discharged into the trough to remove the particles which may fall into the trough through the opening 32.

40 is a jet flushing-pipe in the trough 31 to promote action of the parts precipitated. 41 is a discharge-pipe from the trough 31

The operation of the device or apparatus is as follows: The mill-tailings drop from the pipe 3 into the chamber 2. Water from the pipe 16 enters the chamber 7, the greater portion of it passing up through the neck 5 into the chamber 2, as shown by the arrows, while a smaller portion passes around the valve 9 and escapes into the trough 11. The up-current is rapid enough to prevent the descent of the slime-water in chamber 2 and carries the slime-water up behind the gate 17 through the opening 20 into the chamber 21 and along the chamber over the pipes 26 27. The waste water then passes up behind the deflector 29 into the spout 30 and is discharged through the trough 11 to the dump. As the slime-water passes slowly through the chamber 21 it is acted upon by an innumerable number of air-bubbles escaping from the perforate pipes 26 27, into which the air is forced through pipe 25. The constant upward circulation of air through the slime-water tends to elevate all foreign matter to the surface of the water and to create or form a mass of strong foam having a great carrying energy for matter foreign to water. As the foam accumulates in the chamber 21 it is forced out through the passage 23 to a drier.

By means of this invention valuable min-

eral slime or fines may be saved which have heretofore been lost.

I claim as my invention—

1. The improved method of separating mineral slime or fines, consisting in discharging air beneath the body of slime and causing it to be emitted and permitted to pass upward through the slime, forming a foam, substantially as set forth.

2. The improved method herein shown and described, consisting in depositing the mill-tailings into a receptacle through which there is an upward flow of water, then carrying the water and tailings through a chamber, and causing an upward flow of air through the body of water and tailings, forming a scum, substantially as and for the purpose set forth.

3. The combination of the chambers 2 and 21, an air-pipe 25, having perforated branches for the escape of air, a screen over said branches, and a separate escape for the waste water and scum formed by the passage of the air through the mass, substantially as and for the purpose set forth.

4. The combination of the chamber 2, having a neck 5, a wall 6, forming a chamber 7, the valve 9, secured to an adjustable housing 10, the pipe 16, the gate 17, a chamber 21, having a cover 22, a pipe 25, having perforated branches, a screen 28, a trough 31, communicating with the chamber 21, pipes for cleaning the trough, a deflector 29, spouts 23 and 30 and a trough 11, substantially as and for the purpose set forth.

ALBION M. ROUSE.

In presence of—
JOHN P. HALDEMAN,
C. C. HALDEMAN.

(No Model.) 3 Sheets—Sheet 1

C. B. HEBRON & C. J. EVERSON.

PROCESS OF CONCENTRATING ORES.

No. 471,174. Patented Mar. 22, 1892.

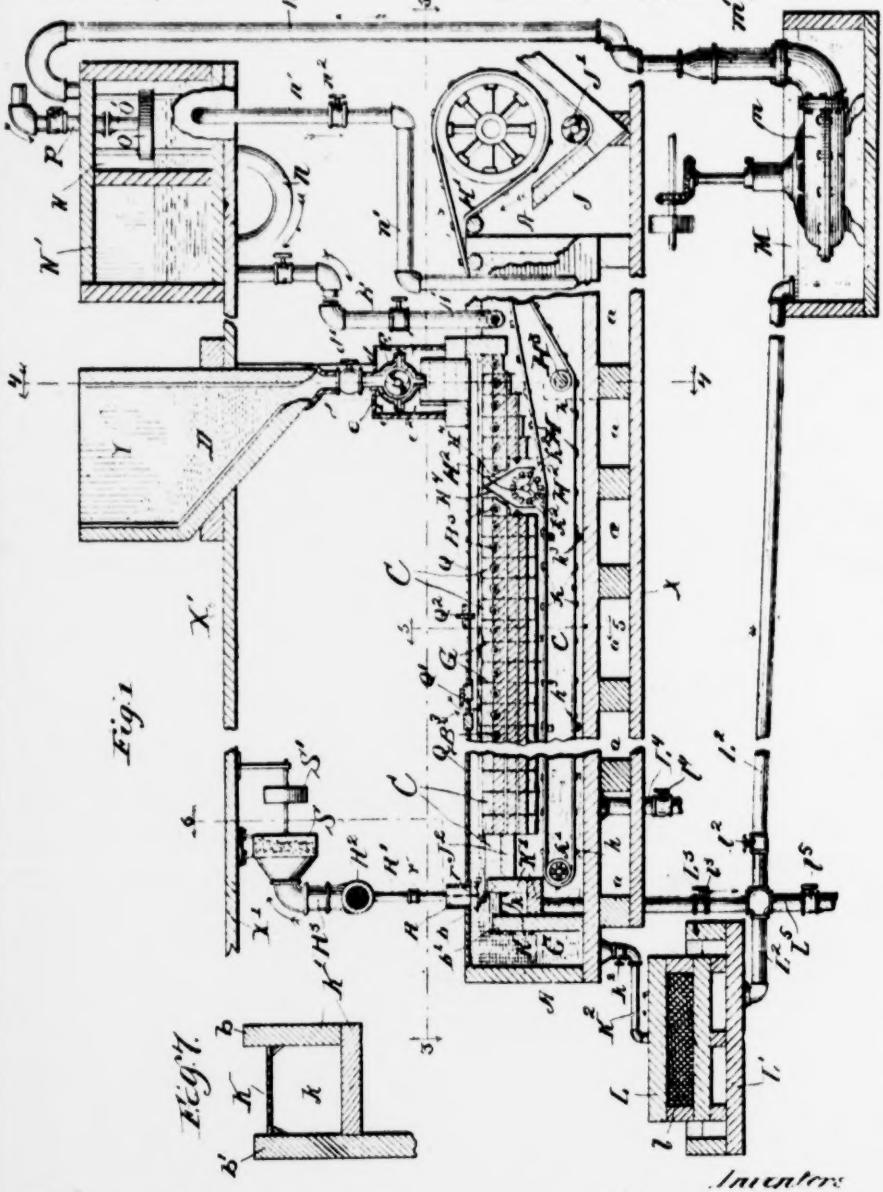


Fig. 1.

Fig. 4.

Witnesses:
Lulu S. Hill
Flora L. Bu...

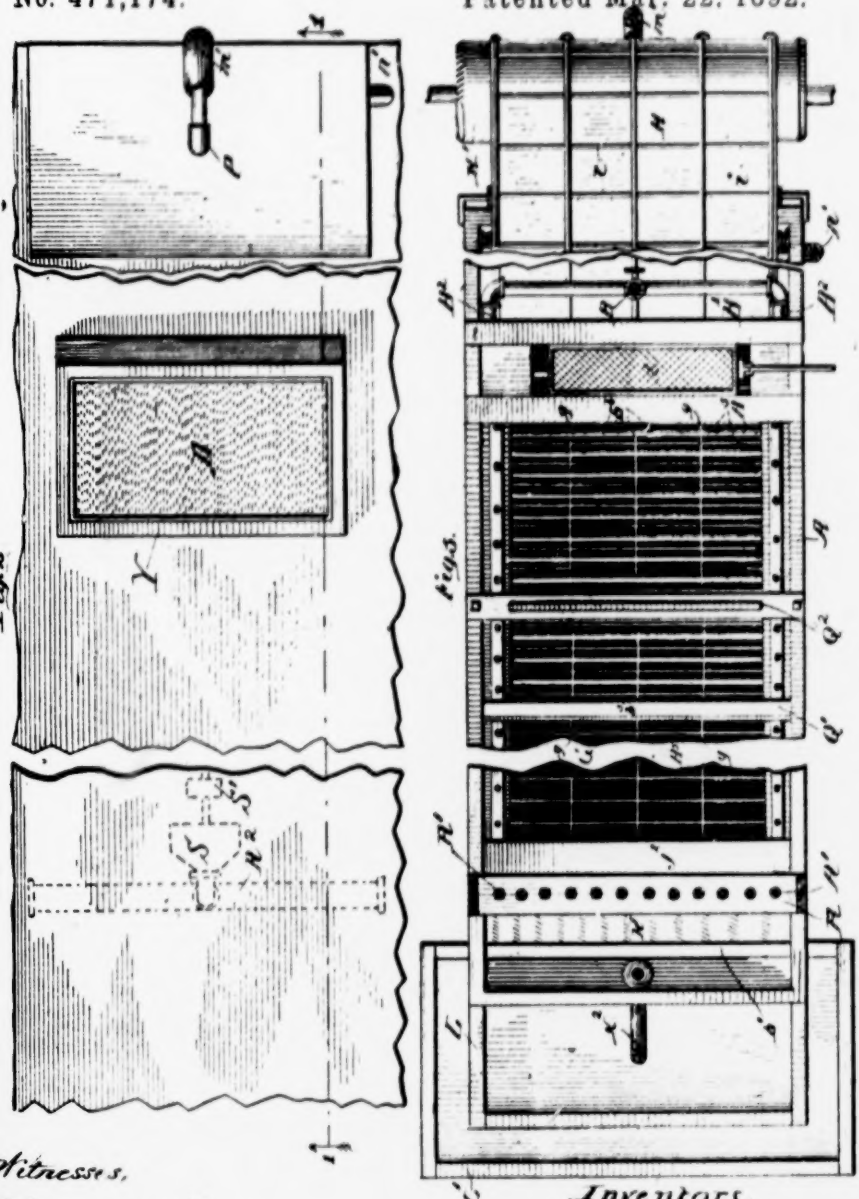
Inventors
Charles B. Hebron
and Carrie J. Everson
By Charles T. B.

(No Model.) 3 Sheets—Sheet 2.

C. B HEBRON & C J EVERSON

PROCESS OF CONCENTRATING ORES.

No. 471,174. Patented Mar. 22. 1892.



Figs.

Witnesses,
Lute S Mar
Flora L Brown

Inventors,
Charles B Hebron
Carrie J Everson
By Charles J Brown, Atty

(No Model.) 3 Sheets—Sheet 3.

C. B. HEBRON & C. J. EVERSON.

PROCESS OF CONCENTRATING ORES.

No. 471,174. Patented Mar. 22, 1892.

2077

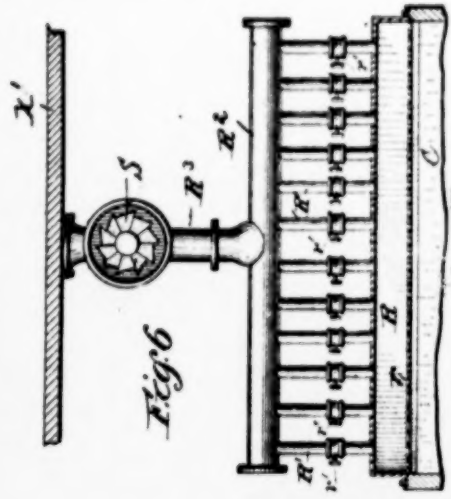


Fig. 6.

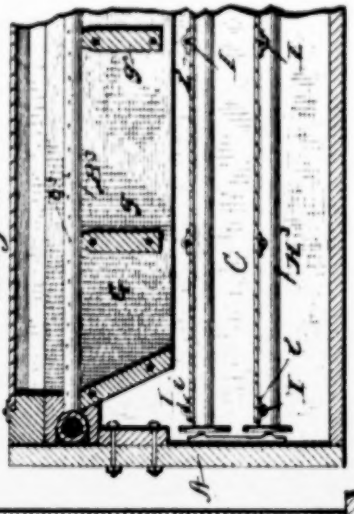


Fig. 5.

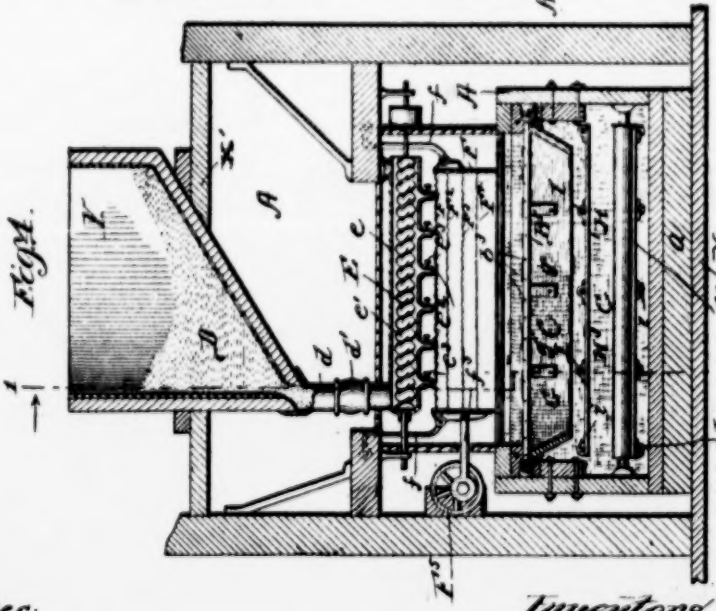


Fig. 4.

Witnesses;
Lute S. Alter
Flora L. Brown.

Inventors.
Charles B. Hebron
and Carrie J. Everson.
By Charles J. P[illegible]

UNITED STATES PATENT OFFICE.

2078

CHARLES B. HEBRON AND CARRIE J. EVERSON, OF DENVER, COLORADO

PROCESS OF CONCENTRATING ORES.

SPECIFICATION forming part of Letters Patent No. 471,174, dated March 22, 1892.

Application filed September 1, 1891. Serial No. 404,400. (No model.)

To all whom it may concern:

Be it known that we, CHARLES B. HEBRON and CARRIE J. EVERSON, both residents of Denver, in the county of Arapahoe and State of Colorado, have made new and useful Improvements in Processes for the Concentration of Certain Ores; and we do declare the following to be a full, clear, and exact description of the invention, such as will enable those skilled in the art to which it appertains to practice the same.

Our invention relates to the concentration of ores, and has for its object the successful and economical separation of the lighter metals and minerals from their associate rock, many of which have never heretofore been successfully separated by mechanical processes—that is, processes wherein the relative specific gravity of the ore values, the rock-matrix of the ore, and the suspensive fluid in which the separation has been attempted have been relied upon for effecting by means of many different mechanical appliances the desired separation of such values from the rock-matrix of the ore.

The failures resulting from the heretofore-known processes may be briefly stated to be due to the effort of inventors of mechanical processes and builders of ore-separators to obtain the desired concentration with processes and machines based upon the theory contained in the statement by text authorities that all metals and minerals are of greater specific gravity than the rock portion of their respective ores, such statement being misleading and untrue because of the porosity of structure and irregularity of form which exists in metallic and mineral particles contained in certain ores whereof the rock-matrix is crystalline, such rock particles having smooth and glassy surfaces, as we have discovered by an extended series of microscopical examinations, wherein the ore examined has been first pulverized to a degree of fineness permitting it to pass through the meshes of a series of Swiss bolting-cloth screens of a mesh varying from one hundred to one hundred and eighty meshes per linear inch and then examining the mineral, metallic, and rock particles of the ore with a microscope producing an enlargement of at least three thousand diameters, and the process embodying our invention has particular reference to the separation or concentration of such ores.

The form and structure of the mineral and metallic particles adapted when contained in a suitable crystalline rock-matrix to be separated by our process is amply illustrated and particularly noticeable in bismuth, silver, copper carbonate, silver chloride, gray copper, ruby silver, tellurides, copper and silver glances, as well as other forms of black sulphurets, wire silver, nearly all native silver, flake and flour gold, and frequently coarser particles of free gold, such mineral and metallic particles being irregular in form, with cavities or depressions on the surfaces thereof, and porous in structure, frequently resembling in appearance coral or sponge or vegetable fibers, as sprigs of moss or segments of fronds. Further, there is a type of ores made up of an argentiferous class of minerals associated with a tough crystalline rock, especially noticeable in spar-gangue carrying gray copper, in which the mineral does not exist in minute particles or in intimate dissemination through the rock, but in coarse particles widely separated from each other and of an extremely rigid though friable texture, for the concentration of which our process is well adapted. In the operation of pulverizing this ore sufficiently to liberate the mineral contained therein, though only a coarse pulverization is required, the mineral becomes reduced to an almost impalpable slime, the particles thereof being sufficiently fine for the requirements of this process. We have also discovered that the buoyancy of the above-named minerals and metallic particles or the tendency of such particles to remain suspended in fluid may be so increased by applying thereto properly-prepared buoyant material in a suitable way and under such pressure as to cause particles thereof to adhere to the irregular surfaces and to be contained or pressed into the cavities or pores of such mineral and metallic particles that they will not only remain suspended in fluid for much longer time than would the mineral and metallic particles when not joined to particles of buoyant material, but also to float upon the surface of liquid for a sufficient time to be separated from the rock-matrix of the ore

by such rock-matrix settling through such liquid. In practicing this invention such properly-prepared buoyant material is evenly distributed with the ore particles by means of shaking or revolving screens or of equivalent mechanical devices, and the mixture so obtained is then submitted to a rubbing movement and pressure, the result being that the particles of buoyant material are pressed into the cavities and pores, or partially so, of the mineral and metallic particles and made to adhere to the rough and irregular surfaces thereof, and they (the joined mineral and metallic particles of the ore and buoyant material) are of less specific gravity for a time than the rock particles of such ore.

We have found ordinary mill-burrs to be effective in the operation of attaching the particles of buoyant material to the metallic and mineral particles of disintegrated ore.

The amount of bouyant material to be added to a given quantity of pulverized ore must be determined by the bulk of the metal or mineral contained in such ore. Experience has shown us that if the amount of foreign buoyant material added to the disintegrated ore be equal to or slightly in excess of the bulk of metal or mineral contained in such ore a sufficient buoyancy will thereby be imparted to the metal and mineral particles after thus joining to admit of their obtaining the upper strata when such prepared ore-stock is submitted to stratifying agencies.

The following list comprises a number of materials which are typical of the substances that may be employed to render metallic and mineral particles buoyant: Charcoal, coke, lamp-black, plumbago, any of the friable vegetable fibers—such as bark, moss, straw, cotton, wool—also sulphur, (sublimed,) aluminum trihydrate, hydrated lime sulphate, sodium oleate and other cheap salts of sodium, also the cheap metallic sulphates and oleates. These salts must be dry not only in the ordinary sense, but entirely dehydrated, so as to render them amorphous. The carbonaceous substances are first named because of their cheapness, their positiveness of action, and their destructibility in the furnace. Sulphur also acts as a fuel and in the free state and proper quantity for carrying out the process would be unobjectionable to the smelter. Lime salts acting as oxidizing fluxes need no consideration, nor do the soluble salts, as they are easily removed from the concentrates before smelting. In operating with soluble salts the water employed in the separator-tank, hereinafter described, must be saturated either with the same salt or with one which will preserve the same conditions—that is, remain incapable of dissolving or reacting chemically upon the salt mixed with the ore and attached to the metallic and mineral particles thereof. To this rule we make certain exceptions—to wit, cases where the newly-formed substance is able to take the place of the one destroyed, as in the case of sodium oleate reacting to form oleic acid or any other oleate or in the case of common alum acting to form aluminium hydrate.

The terms "oleic acid" and "oleate" are here used to embrace the mixed fatty acids and their salts resulting from the decomposition of commercial soaps.

The degree of fineness to which the ore must necessarily be pulverized before the "buoy-stock" (as we shall hereinafter term the buoyant material) is joined thereto is determined by the character of the ore and the manner in which the mineral and metallic particles are disseminated in the rock-matrix of the ore.

While some of the lighter class minerals are found sparsely and intimately disseminated with the rock-matrix of their respective ores and the particles of minerals so minute as to require a pulverization which is commercially impracticable, yet in nearly all cases where the metallic and mineral particles are found in a crystalline rock-matrix constituting an ore otherwise suitable for separation by our process we have found that a pulverization of from ninety to one hundred and sixty mesh, such pulverization being eminently practicable, effectually pulverizes the ore to a degree of fineness which liberates the values from their envelopment

In cases where vegetable fiber or any of the carbonaceous substances are used as a buoy-stock they, together with the disintegrated ore, must be dry before the two are mixed preparatory to the joining of the metallic and mineral particles to and with the buoy-stock. In cases where the chemically-prepared buoy-stock is used the ore and the buoy-stock may be mixed or distributed together in the presence of moisture; but the operation of attaching the buoyant material to the metallic and mineral particles of the ore must be performed after the entire mass thus distributed together has been thoroughly dried.

As our process is only adapted to separate the metallic and mineral particles from a crystalline rock, (an ore with a rock matrix of crystals, as a pure and translucent quartz, or a crystalline spar-gangue being particularly favorable,) no trouble arises in attaching the buoyant material to the metallic and mineral particles of the pulverized ore from any tendency of the buoyant material to adhere to the surface of the rock particles, as the faces of the rock particles are smooth and glassy and offer no position of lodgement for such buoyant material.

We do not claim any value for this process if it be applied to an ore with a talc or clayey gangue, or, except for the separation of the lighter mineral and metallic particles, when applied to an ore containing galena or pyrites of cubical formation.

When ores adapted for treatment by this process are prepared in the foregoing man-

ner, a separation may be effected with more or less perfection if the thus-prepared stock be submitted to any of the standard dry or wet concentrators. In case a dry separator be used the buoyed values of the ore-stock will attain the position reached by the gangue when the conventionally-prepared ore-stock is put in the machine, and the rock particles will be delivered to the position that the product is delivered in such cases, and if the ore-stock prepared by our method is delivered by means of sifting or blowing to the surface of the water contained in or upon wet concentrators the reverse of position to that of the product and waste of the ordinarily-prepared ore-stock in the use of the machine is attained by the product and the waste. Repeated experiments have proven to us that the standard concentrators in use—such as air-jigs, oscillating tables, wet jigs, frue vanners, or percussion-tables—may be adjusted to admit of a fairly good separation; but there are mechanical barriers to the perfect separation, or, more particularly, to the rapid and economical operation of the same. Therefore we submit a description of a device, the invention of Charles B. Hebron, peculiarly suited to the successful operation of separating the buoyed values from the rock particles of the ore-stock as prepared in the hereinbefore-described manner and an illustration of such device in the drawings accompanying and forming a part of this specification, in which—

Figure 1 is a longitudinal sectional view of a liquid-separator on line 1 1 of Fig. 2, viewed in the direction indicated by the arrows; Fig. 2, a plan view; Fig. 3, a horizontal sectional view on line 3 3 of Fig. 1, viewed in the direction indicated by the arrows, the top of the tank of the separator being transparent and so exposing to view the several parts contained in the tank; Fig. 4, a vertical cross-section on line 4 4 of Fig. 1, viewed in the direction indicated by the arrows; Fig. 5, a vertical cross-section, on an enlarged scale, of a portion of the device on line 5 5 of Fig. 1, viewed in the direction indicated by the arrows; Fig. 6, a vertical cross-section on line 6 6, Fig. 1, also viewed in the direction indicated by the arrows; and Fig. 7, a detail view of the foraminated plate (illustrated in Fig. 1) near the tail end of the tank of the separator, and hereinafter termed a "perforated table."

The same letter of reference is used to indicate a given part where more than one view thereof is shown.

X X' are floors of the building in which the separator is placed.

Y is the storage for the ore-stock which is to be run through the separator.

A is a tank adapted to hold liquid, constructed of any suitable material, but preferably of wood, and rectangular in shape, with its greatest length from the head to the tail.

a a are timbers resting on the floor X, extending transversely across between the tank A and the floor X, on which timbers the tank rests.

The liquid contained in the tank, preferably water or brine—that is, water saturated with common salt—is supplied thereto through the pipe B at the head end of the tank and is ultimately discharged over the bridge walls or partitions *b b'* at the tail end of the tank. Such liquid is lettered C. The pipe B extends downward to underneath the surface of the liquid C in the tank and at its lower end is connected with a series of horizontal pipes consisting of transverse pipe B', longitudinal pipe B^2, and smaller transverse pipes B^3 B^3.

b^2 b^2 are perforations on the upper half of each of the transverse pipes B^3 B^3, through which the liquid C enters the tank, there being sufficient head in the pipe B to force the liquid out of the perforations in a manner to produce a slight effervescing condition in such liquid directly over such perforations.

D is the ore-stock, properly prepared, contained in the storage Y.

d is a pipe having valve *d'* therein, extending from storage Y to transverse conveyer E. Conveyer E consists of tube or trough *e* and conveyer-screw *e'*, nipples e^2 e^2, extending downward from tube or trough *e*, and valves e^3 e^3 in such nipples.

e^4 is a driving-pulley on the shaft of the conveyer-screw by which such conveyer-screw is turned.

F is an oscillating frame suspended on vibratory arms *f f*, adapted to be rapidly moved a slight distance backward and forward or oscillated by the cam-wheel F^3 through connecting-arm f^3.

F' F^2 F^2, respectively, are screens in frame F, forming a series of screens through which the ore-stock D, delivered from the nipples e^2 e^2 on the upper one thereof, passes just prior to its delivery to the surface of the liquid C in the tank A.

The purpose of the several mechanisms between the storage Y and the tank A is to insure the taking of the prepared ore-stock D from such storage and the delivery of the same to the surface of the liquid C in the form of a dust-cloud, whereby a thin surface charge of prepared ore-stock shall be obtained on the liquid C, near the head of the tank A, underneath the lower one of the screens forming the series. The ore-stock thus delivered to and contained on the surface of the liquid C in the tank A and consisting of the pulverized and buoyed values and the pulverized rock matrix or gangue are separated from each other in the tank, the purpose of the several mechanisms contained in the tank being to so separate the buoyed values in such ore-stock from the gangue thereof and to deliver such buoyed values at or near the tail end of the tank and to deliver the gangue of the ore-stock from the head end of the tank.

G G G are vertical partitions extending

transversely across the tank, the upper edge of each partition being a slight distance below the surface of the liquid C and the lower edge a short distance above an endless apron-belt, by which apron-belt the gangue settling through the liquid is carried from the tank.

g g are braces extending between partitions G G, respectively.

H is such endless apron-belt having taut cleats *h h h* thereon and longitudinal ropes I I fastened thereto by the straps *i i*, such straps being, preferably, sewed to the belt H. Apron-belt H extends longitudinally through the tank and out therefrom over the edge of the head end thereof, and from thence over the drum H', by which drum it is moved.

The upper and carrying portion of the apron-belt H for the greater part of the length thereof is substantially horizontal, being held in position at the point of junction of the horizontal part extending along in the tank with the inclined part extending out of the tank over the edge of the head thereof by the sprocket-reel H^2, having projections h^2 h^2 thereon, and the horizontal position of the remainder of the carrying portion of the belt is obtained by such apron-belt extending around the roller or drum *h'* and idlers h^3 h^3. The lower or ingoing portion of the endless apron-belt is held in place by the roller or drum H^3. To prevent any possible disturbance of the surface of the liquid C by the movement of the sprocket-reel H^2 there is placed over it the housing H^4.

J is a spout or trough underneath the drum H', adapted to receive the gangue delivered from the endless apron-belt H as such belt travels around the drum H', and J' is a common screw conveyer by which the spout or trough J is emptied.

J^2 is a horizontal planking forming a cover for the endless apron-belt at the tail end of the tank and also forming on the upper surface thereof a horizontal bed by which, from inspection of the settlings thereon, if any, the presence of gangue in the liquid about to pass over the bridge-wall *b* can be determined.

K is a perforated table forming a sieve, through which the greater part of the liquid passing over the bridge-wall *b* can pass into chamber *k*, such chamber *k* being formed by planking K' and bridge-walls *b b'*. The liquid passing over the bridge-wall *b'*, carrying on the surface thereof the buoyed mineral and metallic particles from the ore-stock, flows through the pipe K^2 into receptacle L.

l l are screens in receptacle L, through which the liquid passing into such receptacle can pass into receptacle L', thereby leaving the buoyed mineral and metallic particles in the receptacle L, from which they are taken to be afterward treated in any desired manner.

L^2 is a pipe extending from receptacle L' to and communicating with receptacle M, and F^2 is a valve in pipe L^2.

L^3 is a pipe which extends from chamber *k* to pipe L^2 and is joined to pipe L^2 by means of a common T-joint, and pipe L^3 extends from pipe L^2, forming a continuation of pipe L^2.

F^3 is a valve in pipe L^3.

When valve F^3 in pipe L^3 or valve F^2 is open and valve F^3 in pipe L^3 is also open, the liquid in chamber *k* can pass therefrom through the pipe L^3. The proportion of the liquid passing over the screen K which is permitted to pass through such screen into chamber *k*, and from thence through pipe L^3, is determined by the valve F^3, and the direction such escaping liquid flows is determined by the valves F^2 and F^3, respectively—as, for instance, closing valve F^3 and opening valve F^2 guides the liquid into a receptacle, from which it is returned, by means hereinafter described, to the storage-reservoir, from which the pipe B extends, and opening the valve F^3 permits the liquid to flow to waste.

When it is desired to empty the tank A of the liquid contained therein without allowing such liquid to pass over the bridge-walls *b b'*, as for cleaning out the tank or flushing it, the valve F^3 in pipe L^3 is opened; but ordinarily valve F^3 is maintained in a closed condition

m is a centrifugal pump in receptacle M, and *m'* is a pipe from the centrifugal pump *m* to the tank N. The liquid flowing into receptacle M through pipe L^2 is forced by the pump *m* into tank N through pipe *m'*.

O is a float-valve in tank N, and O' is the stem thereof, adapted to close the pipe P (such pipe P extending from a liquid-supply) when the liquid contained in the tank N is raised a determined amount and to open such pipe when less than the determined amount of liquid is contained in such tank. By means of this valve O the pipe P when the liquid returned to the tank N through the pipe *m'* is insufficient to maintain the desired height of liquid in tank N the additional liquid required is automatically supplied through the pipe P.

N' is the liquid-storage tank from which the liquid is taken through the pipe B to supply the tank A, and *n* is a pipe connecting the tank N with tank N'. The use of pipe *n* is to prevent any pulsation in tank N' from the movement of the centrifugal pump M or the water passing therethrough into tank N.

In order to supply liquid directly to tank A from tank N, as in the case of desiring to flush the bottom of the tank A, supply-pipe *n'*, having valve n^2 therein, is connected at its upper end with the storage-receptacle N and at its lower end with the tank A.

Q is the cover of the tank A, and Q' is a slide in cover Q, which can be moved to produce an opening of any desired size in the cover Q.

Q^2 is a partition extending transversely across the tank A from the cover Q to near the surface of the liquid C in the tank.

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The slide Q′ and the partition Q^2 are adjustable, the joint functions of the two being to determine the quantity of air drawn through the tank by the fan S and its source—that is, when the slide Q^2 is near the surface of the liquid C in the tank and the slide Q′ is opened widely nearly all the air passing through the tank will pass through the opening covered by the slide Q′, and a small portion thereof will be supplied underneath the slide or partition Q^2, while a larger quantity of air will pass under the partition Q^2 if such partition be raised farther away from the liquid C. The partition Q^2 has another function—namely, to deflect all, if any, particles of ore-stock floating above the liquid C (in the air between the surface of liquid C and cover Q) downward to the surface of such liquid as it passes underneath the slide Q^2.

R is a chamber extending transversely across the tank near the tail end thereof, and r is a perforated screen between the chamber R and the tank A.

R′ R′ are a series or pipes extending from the chamber R to the transverse pipe or conduit R^2, and r′ r′ are valves in pipes R′ R′, respectively.

R^3 is a pipe extending from the transverse pipe R^2 to and communicating with the exhaust-fan S.

S′ is the driving-pulley by which the exhaust-fan S is rotated.

When the exhaust-fan S is in operation and the slide Q′ in cover Q is open, a current of air will extend from the slide Q′ over the surface of the liquid contained in the tank, and from thence through the screen into the chamber R, and from thence through the several pipes R′, R^2, and R^3 to and through the exhaust-fan S. By means of the series of valves r′ r′ and the screen r the amount and direction of the moving current of air can be definitely determined, it being understood that the opening of the slide Q′ is properly adjusted for the amount of current desired.

In the operation of this device the liquid entering the tank A through the perforations b^3 b^3 in pipes B^3 B^3 flows over the top of the partitions G G G along toward the tail end of the tank and over the bridge-wall b, an effervescing movement being produced, as hereinbefore described, in the liquid C over the perforations b^3 b^3 b^3 and a wave-like movement being produced the entire length of the tank by the partitions G G G. The buoyed mineral and metallic particles of the ore-stock will be found floating in the form of a scum upon the surface of the liquid along with such liquid toward the tail end of the tank, and when the exhaust-fan S is in operation the wave-like movement of the surface of the liquid is increased and a movement of such buoyed mineral and metallic particles along upon and over the surface of the liquid C at a rate in excess of the rate of movement of the liquid C is obtained, thereby producing a frictional movement facilitating the separation of such buoyed mineral and metallic particles from the gangue of the ore-stock, whereby the capacity of the separator is increased.

Having thus described our invention, what we claim, and desire to secure by Letters Patent, is—

1. The herein-described process for concentrating ores, which consists in commingling with pulverized ore-stock buoyant material, then submitting the commingled pulverized ore-stock and buoyant material to movement and pressure and so joining the buoyant material to the metallic and mineral particles in the pulverized ore, and then applying the prepared ore while in a dry state to a stratifying apparatus, whereby the buoyed metallic and mineral particles are separated from the gangue by the settling of such gangue, substantially as described.

2. The herein-described process for concentrating ores, which consists in first commingling with pulverized ore-stock buoyant material, then submitting the commingled pulverized ore-stock and buoyant material to movement and pressure and so joining the buoyant material to the metallic and mineral particles in the pulverized ore, and then applying such prepared ore while in a dry state to the surface of liquid, whereby the buoyed metallic and mineral particles are floated on such liquid and separated from the gangue, which settles in the liquid, substantially as described.

3. The process, substantially as described, for concentrating ores, which consists in first joining the metallic and mineral particles in the pulverized ore with a quantity of buoyant material and then sifting or blowing the prepared ore while in a dry state upon the surface of liquid, whereby the buoyed metallic and mineral particles are made to float and thus separate from the gangue, which settles.

4. The herein-described process for concentrating ores, which consists in first joining the metallic and mineral particles in the pulverized ore with a quantity of buoyant material, then sifting or blowing the prepared ore while in a dry state upon the surface of liquid, and then in obtaining a current of air over the liquid, whereby the buoyed metallic and mineral particles are made to float and to move along on and over the surface of such liquid, and thus separate from the gangue, which settles.

5. The herein-described process for concentrating ores, which consists in first joining the metallic and mineral particles in the pulverized ore with a quantity of buoyant material, of obtaining a body of liquid having an effervescent condition, and then sifting or blowing the prepared ore while in a dry state upon the surface of liquid in such effervescing condition, whereby the buoyed metallic and mineral particles are made to

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471,174

float on the surface of such liquid, and thus separate from the gangue, which settles

6. The herein-described process for concentrating ores, which consists in first joining the metallic and mineral particles in the pulverized ore with a quantity of buoyant material, of obtaining a body of liquid having an effervescent condition, then sifting or blowing the prepared ore while in a dry state upon the surface of liquid in such effervescing condition, and then in obtaining a current of air over the liquid, whereby the buoyed metallic and mineral particles are made to float and to move along on and over on the surface of such liquid, and thus separate from the gangue, which settles.

CHARLES B. HEBRON.
CARRIE J. EVERSON.

Witnesses to signature of Charles B. Hebron:

CHARLES T. BROWN,
J. L. EVERSON.

Witnesses to signature of Carrie J. Everson:

E. A. FAY,
B. CURTIS.

No. 653,340. Patented July 10, 1900.

F. E. ELMORE

APPARATUS FOR SEPARATING METALLIC FROM ROCKY CONSTITUENTS OF ORES.

(Application filed Sept. 28, 1899.)

(No Model.) 2 Sheets—Sheet 1

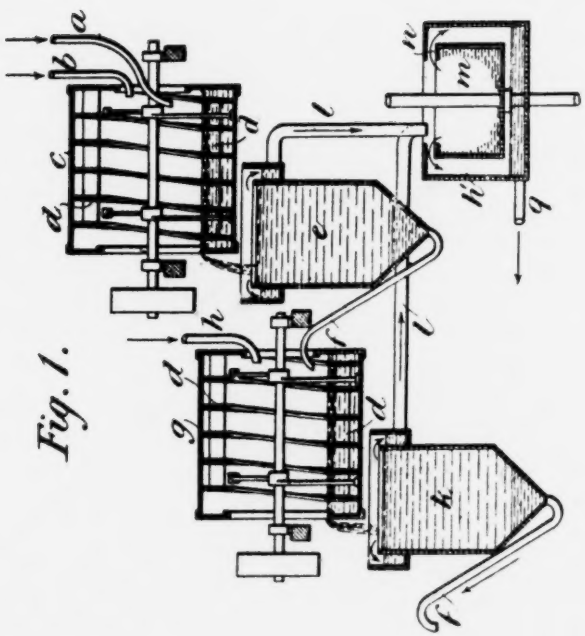


Fig. 1.

Witnesses
A. B. Kuhn
Dennie Dunlyn

Inventor
Frank E. Elmore
by James L. Norris
Atty

No. 653,340. Patented July 10, 1900

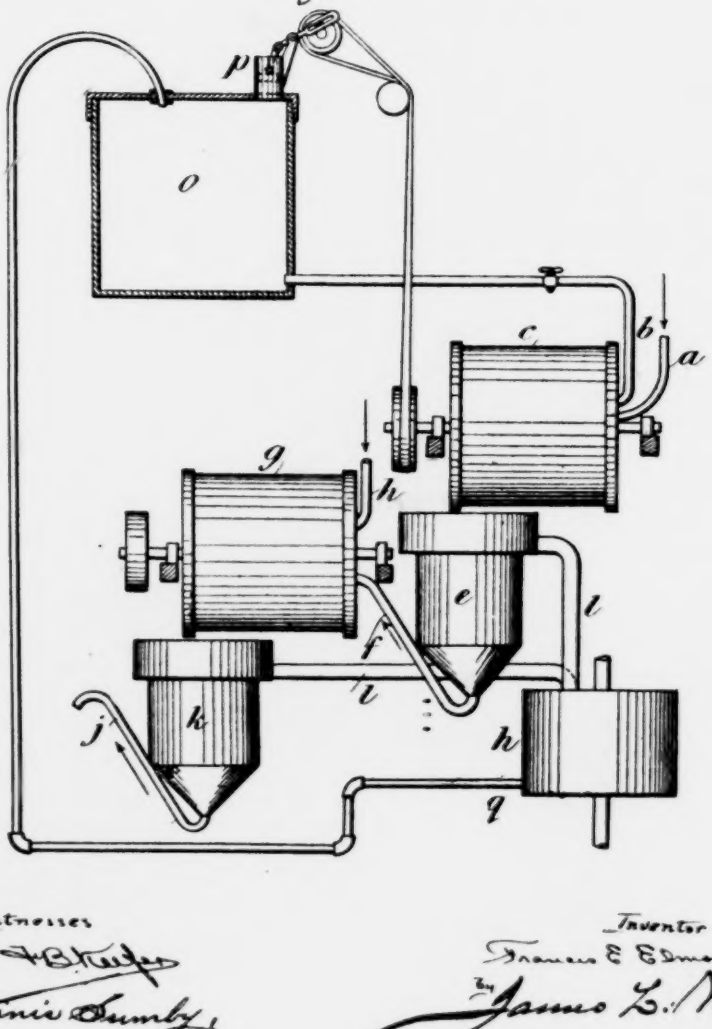
F. E ELMORE.

APPARATUS FOR SEPARATING METALLIC FROM ROCKY CONSTITUENTS OF ORES.

(No Model.) (Application filed Sept. 23, 1899.) 2 Sheets—Sheet 2

2086

Fig. 2.



Witnesses
H. B. Tuttle
Dennis Dumby

Inventor
Frances E Elmore
By James L. Norris

UNITED STATES PATENT OFFICE.

FRANCIS EDWARD ELMORE, OF LEEDS, ENGLAND.

APPARATUS FOR SEPARATING METALLIC FROM ROCKY CONSTITUENTS OF ORES.

SPECIFICATION forming part of Letters Patent No. 653,340, dated July 10, 1900.

Original application filed April 10, 1899, Serial No. 712,454. Divided and this application filed September 23, 1899. Serial No. 731,484. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS EDWARD ELMORE, a citizen of England, residing at Pontefract road, Hunslet, Leeds, in the county of York, England, have invented certain new and useful Improvements in Apparatus for Separating Metallic from Rocky Constituents of Ores, (for which I have applied for a patent in Great Britain, dated October 18, 1898, No. 21,948,) of which the following is a specification.

This invention, which was originally comprised in the application for patent filed April 10, 1899, Serial No. 712,454, but has been divided out at the request of the Office, relates to apparatus for separating the metallic from the rocky constituents of ores, which I effect by bringing a mixture of the pulverized ore with water into contact with more or less thick oil, which entraps the metallic constituents and allows the rocky constituents to pass away with the water. I then separate the metallic particles from the oil, which can be used for repeated operations. The thick oil which I employ is the thick tarry residue, usually called "residuum," of mineral oil after some of the more volatile constituents have been distilled off. When the whole of the ore has been mixed with water in quantity amounting to several times the weight of the ore, this is then mixed with the thick oil. The metallic portions of the ore are retained in the oil, which does not even adhere to the earthy ingredients, the latter being held in suspension in the water.

In the accompanying drawings, Figure 1 is a vertical sectional view of an apparatus suitable for carrying my invention into effect, omitting the elevated cistern; and Fig. 2 is a side elevation of the apparatus, showing the elevated cistern.

In order to enable those skilled in the art to practice my invention, I will now describe the same in detail with reference to the drawings.

The mixture of pulverized ore and water supplied by pipe *a* and also the oil supplied by pipe *b* flow into one end of a drum *c*, which slowly revolves on a horizontal axis. At each end of the drum there is a circular opening, and within the drum annular helical ribs *d* extend from end to end, the spaces between these ribs being divided into cells by a number of equidistant blades. The ore and water and the oil, which are thus mingled without being broken up, so as to form a uniform mixture, are carried from the end of the drum where they entered to the opposite end, whence they are discharged into a water-subsiding vessel *e*, in which the water and rocky constituents mostly subside, while the oil, with the metallic constituents, floats above. The lowest layer is drawn away as tailings, which may be again treated with oil by leading them by a pipe *f* to a second drum *g*, where they are again mixed with oil supplied by a pipe *h*, the mixture being discharged into a second subsidence vessel *k*. This may be again repeated until little or none of the metallic constituents remain in the tailings. The upper layer from the subsidence vessels is led by pipes *l* into a centrifugal drum *m*, containing a little water. As the drum rapidly revolves the metallic particles are caused by centrifugal force to pass from the oil to the water, which forms a layer next the circumference of the drum, the side of which is closed, while the oil, being lighter, flows over an inwardly-projecting lip *n* into the casing *h'* of the drum, whence it is removed by a pipe *q* to be used over again. When the layer of particles and water in the centrifugal drum attains a certain thickness, the drum is stopped, the layer is removed, and the drum receives a fresh charge of water and is again worked.

The oil may be pumped up through pipe *q* to an elevated cistern *o* to supply the drums *c* and *g*; but in order to clear the oil from air-bubbles I prefer to draw the oil up to the cistern by creating a partial vacuum in the cistern through the medium of any suitable means, such as a vacuum-pump *p*.

In carrying out my invention I do not employ an oil mixture. The thick oil of the kind before set forth, with the metallic ingredients entrapped in it, floats over the water, which holds in suspension the earthy ingredients which have no oil whatever adhering to them.

Instead of employing centrifugal force to separate the oil from the metallic matters mixed with it the mixture may be thinned by heating it or mingling it with solvents of the

oil, such as benzoline, and left for subsidence or subjected to filter-pressing, so that the greatest portion of the oil can be recovered for subsequent use.

Having thus described the nature of this invention and the best means I know of carrying the same into practical effect, I claim—

1. The combination in an apparatus for separating metallic from rocky constituents of ore, of a rotary drum having internal helical ribs, pipes for delivering oil and ore and water into one end of said drum, a water-subsiding vessel arranged below the drum and receiving the oil, ore and water therefrom, a centrifugal drum arranged below said water-subsiding vessel, and a pipe for conducting the metallic portions and the oil from the top of the water-subsiding vessel into said centrifugal drum, substantially as described.

2. The combination in an apparatus for separating metallic from rocky constituents of ore, of a rotary drum having internal helical ribs divided into cells by longitudinal blades, pipes for delivering oil and ore and water into one end of said drum, a water-subsiding vessel arranged below the drum and receiving the oil, ore and water therefrom, a centrifugal drum arranged below the water-subsiding vessel and constructed with an inwardly-projecting lip and a surrounding casing, and a pipe for conducting the metallic portions and oil from the top portion of the water-subsiding vessel into said centrifugal drum at a point in proximity to the inwardly-projecting lip thereof, substantially as described.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

FRANCIS EDWARD ELMORE.

Witnesses:
FRANCIS W. FRIGOUT,
A. NUTTING.

2089

No. 676,679. Patented June 18, 1901.

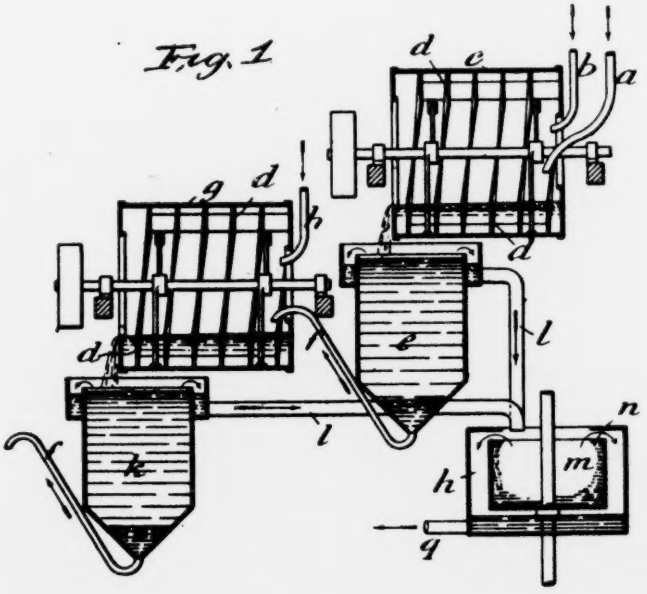
F. E ELMORE

PROCESS OF SEPARATING METALLIC FROM ROCKY CONSTITUENTS OF ORES.

(Application filed Apr 10, 1899.)

(No Model.) 2 Sheets—Sheet 1

Fig. 1



Witnesses
Bruce A Elliott

Inventor
Francis E Elmore
By James L. Norris
Atty

No. 676,679 Patented June 18, 1901.

F. E. ELMORE.

PROCESS OF SEPARATING METALLIC FROM ROCKY CONSTITUENTS OF ORES.

(No Model.) (Application filed Apr 10, 1899.)

2 Sheets—Sheet 2

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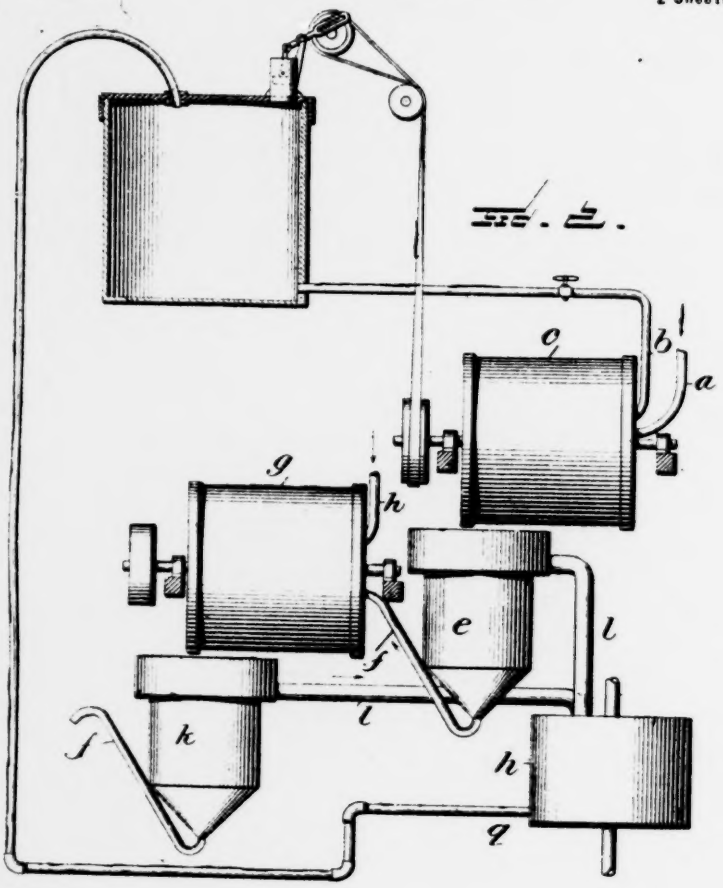


Witnesses
L. C. Hills
H. B. Keeler

Inventor:
Francis E. Elmore
By James L. Norris
Attorney

UNITED STATES PATENT OFFICE.

FRANCIS EDWARD ELMORE, OF LEEDS, ENGLAND

PROCESS OF SEPARATING METALLIC FROM ROCKY CONSTITUENTS OF ORES.

SPECIFICATION forming part of Letters Patent No. 676,679, dated June 18, 1901.

Application filed April 10, 1899. Serial No. 712,454. (No specimens.)

To all whom it may concern:

Be it known that I, FRANCIS EDWARD ELMORE, electrometallurgist, a citizen of England, residing at Pontefract road, Hunslet, Leeds, in the county of York, England, have invented certain new and useful Improvements in Processes of Separating Metallic from Rocky Constituents of Ores, (for which I have applied for a patent in Great Britain, dated October 18, 1898, No. 21,948,) of which the following is a specification.

My invention relates to a method of separating metallic constituents of ore from rocky and other impurities, which is distinguished from the usual amalgamation processes in which the ore forms an amalgam with mercury.

It consists in mixing the crushed ore with water and mixing with the ore and water a substance other than mercury which has the power of causing the metallic portions of the ore only to adhere to it, while the water and rock or other impurities of the ore remain unaffected and may be drawn off. The metallic constituents of the ore are then recovered from the substance in which they are entrapped. I have found that the heavier oils are efficacious for this purpose and particularly that kind of oil known as the "residuum" of mineral oil after the more volatile elements have been distilled off.

In carrying out my process I prefer to mix the ore with water—as, for instance, by the wet crushing method in common use—using a sufficient quantity of water to make a freely-flowing mixture, the fineness of the ore depending upon the particular kind of ore treated. I then place the ore and water in a suitable vessel, add a quantity of the oil depending upon the particular kind of ore under treatment, and then agitate the mixture without breaking up the oil into small globules. The metallic particles will adhere to the oil and be buoyed up and floated by it, while the other constituents of the ore will remain in the water. The water and attendant impurities are then drawn off, leaving the oil and metallic particles. The metallic particles are easily separated from the oil by mechanical or other means.

In the accompanying drawings, Figure 1 is a vertical sectional view of an apparatus suitable for carrying my invention into practice, omitting the elevated cistern; and Fig. 2 is a side elevation of the apparatus, showing the elevated cistern.

In order to enable those skilled in the art to practice my invention, I will now describe the same in detail, with reference to the drawings.

The mixture of pulverized ore and water supplied by pipe *a* and also the oil supplied by pipe *b* flow into one end of a drum *c*, which slowly revolves on a horizontal axis. At each end of the drum there is a circular opening, and within the drum annular helical ribs *d* extend from end to end, the spaces between these ribs being divided into cells by a number of equidistant blades. The ore and water and the oil, which are thus mingled without being broken up so as to form a uniform mixture, are carried from the end of the drum where they entered to the opposite end, whence they are discharged into a vessel *e*, in which the water and rocky constituents mostly subside, while the oil, with the metallic constituents, floats above. The lowest layer is drawn away as tailings, which may be again treated with oil by leading them by a pipe *f* to a second drum *g*, where they are again mixed with oil supplied by a pipe *h*, the mixture being discharged into a second subsidence vessel *k*. This may be again repeated until little or none of the metallic constituents remain in the tailings. The upper layer from the subsidence vessels is led by pipes *l* into a centrifugal drum *m*, containing a little water. As the drum rapidly revolves the metallic particles are caused by centrifugal force to pass from the oil to the water, which forms a layer next the circumference of the drum, the side of which is closed, while the oil, being lighter, flows over an inwardly-projecting lip *n* into the casing *h'* of the drum, whence it is removed by a pipe *q* to be used over again. When the layer of particles and water in the centrifugal drum attains a certain thickness, the drum is stopped, the layer is removed, and the drum receives a fresh charge of water and is again worked.

The oil may be pumped up through pipe *q* to an elevated cistern *o* to supply the drums *c* and *g*; but in order to clear the oil from

air-bubbles I prefer to draw the oil up to the cistern by creating a partial vacuum in the cistern through the medium of any suitable means, such as a vacuum-pump *p'*.

In carrying out my invention I do not employ an oil mixture. The thick oil of the kind before set forth, with the metallic ingredients entrapped in it, floats over the water, which holds in suspension the earthy ingredients which have no oil whatever adhering to them.

Instead of employing centrifugal force to separate the oil from the metallic matters mixed with it the mixture may be thinned by heating it or mingling it with solvents of the oil, such as benzolin, and left for subsidence or subjected to filter-pressing, so that the greatest portion of the oil can be recovered for subsequent use.

Having thus described the nature of this invention and the best means I know of carrying the same into practical effect, I claim—

1. The process of separating the metallic from other constituents of ore, which consists in mixing with crushed ore to which sufficient water has been added to make a flowing mixture a substance other than mercury to which the metallic particles only will adhere, and then recovering the metallic particles from such substance, substantially as described.

2. The process of separating the metallic constituents of ore from the rocky or other impurities, which consists in mixing crushed ore with a sufficient quantity of water to make a flowing mixture, mixing with the ore and water a quantity of oil, and recovering the metallic particles from the oil, substantially as described.

3. A process of separating the metallic from the other constituents of ore, which consists in mixing crushed ore and water to form a flowing mixture, mixing with the ore and water a substance other than mercury to which the metallic particles only will adhere, separating the water and impurities from the substance containing the metal, and recovering the metal from such substance, substantially as described.

4. The method of separating the metallic from other constituents of ore which consists of commingling pulverized ore to which sufficient water has been added to make a flowing mixture with oil, separating the oil and metallic constituents contained therein from the water and impurities, and separating the metallic constituents from the oil, substantially as described.

5. A process for separating metallic from rocky constituents of ore by mixing the pulverized ore with water and mixing the ore and water with oil, allowing the water carrying rocky materials to subside, while the oil carrying metallic constituents floats above, and separating the oil from those constituents substantially as described.

6. The improved process for separating metallic from rocky constituents of ore which consists in mixing the pulverized ore with water, flowing the same into contact and admixture with flowing oil, subjecting the mixture of ore, water and oil to subsidence, and then separating the oil from the rocky constituents and water, substantially as described.

7. The herein-described process for separating the metallic from the rocky constituents of ore, which consists in first mixing pulverized ore with a large quantity of water to maintain the mixture in a freely-flowing condition, then adding to this mixture of water and ore a thick oil of the character set forth, which oil will adhere to the metallic constituents but not to the wet rocky constituents, then subsiding the water and rocky material and causing the oil carrying the metallic constituents to float off over the body of water and finally separating said oil from said metallic constituents, substantially as specified.

8. The herein-described process for separating the metallic from the rocky constituents of ore, which consists in first mixing pulverized ore with a large quantity of water to maintain the mixture in a freely-flowing condition, then adding to this mixture of water and ore a thick oil of the character set forth, which oil will adhere to the metallic constituents but not to the wet rocky constituents, then subsiding the water and rocky material and causing the oil carrying the metallic constituents to float off over the body of water and finally separating said oil from said metallic constituents by centrifugal action, substantially as specified.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

FRANCIS EDWARD ELMORE.

Witnesses:

THOMAS BROWN,

THOBIAS HENRY BUTT.

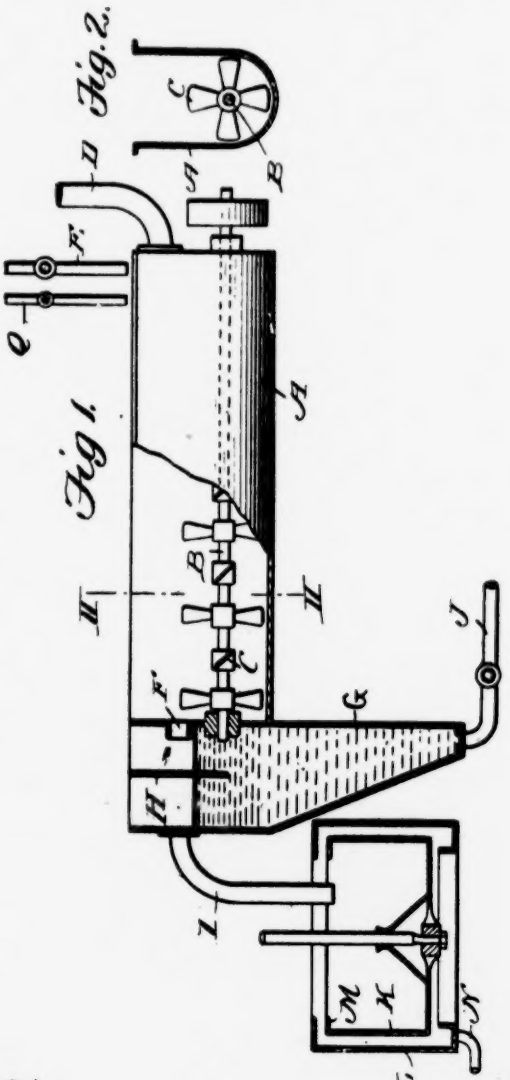
No. 689,070. Patented Dec. 17, 1901.

A. S. ELMORE.

SEPARATING MINERAL SUBSTANCES BY THE SELECTIVE ACTION OF OIL

(Application filed Apr. 13, 1901.)

(No Model.)



Witnesses:
C. D. Kesler
H. B. Kiefer

Inventor
Alexander S. Elmore
By James L. Norris.
Atty

UNITED STATES PATENT OFFICE.

2094

ALEXANDER STANLEY ELMORE, OF LONDON, ENGLAND

SEPARATING MINERAL SUBSTANCES BY THE SELECTIVE ACTION OF OIL.

SPECIFICATION forming part of Letters Patent No. 689,070, dated December 17, 1901

Application filed April 13, 1901. Serial No. 55,776. (No specimens.)

To all whom it may concern:

Be it known that I, ALEXANDER STANLEY ELMORE, a citizen of England, residing at 4 Bishopsgate street Within, London, England, have invented a certain new and useful Improvement in Separating Mineral Substances by the Selective Action of Oil, (for which I have applied for a patent in Great Britain, dated March 28, 1901, No. 6,519,) of which the following is a specification.

The selective action of oil has been utilized for separating metallic substances from earthy or rocky constituents of ores. This has generally been done by pulverizing the ore and suspending it in a considerable quantity of water, so as to make a freely-flowing pulp, then mingling with it oil, preferably heavy oil, such as is obtained from petroleum after some of the lighter oils have been distilled from it. When the mixture rests, the oil, with most of the metallic substances entrapped in it, floats at the top and is separated from the rocky or earthy matters, which are run off with the water as tailings. The oil is afterward separated from the metallic substances, usually by centrifugal action. In carrying on this separating process I have discovered that in some cases a slight acidulation of the mixture greatly enhances the selective action of the oil, so that metallic substances, as well as other mineral substances, such as sulfur and plumbago, can be separated from the earthy matters with which they are naturally associated better than when there is no acid present. By this means some metallic substances can be separated from others—such, for instance, as sulfids from oxids. The acidulation may be effected either by adding a little acid to the oil, in which case an acid that will dissolve in or mix readily with the oil, but which is insoluble, or nearly so, in water—as, for instance, oleic acid—is to be preferred, or the acid may be added to the aqueous pulp, in which case sulfuric acid may be employed or the acid cuprous liquors obtained in mine working. The quantity of acid added in either case is small, as it often need not exceed one five-hundredth part of the volume of oil or water employed in the operation. The quantity of acid required to produce the best result varies, according to the character of the material treated, and I therefore do not confine myself to any definite proportion.

An apparatus by which my process can be carried out in practice and which forms the subject of a pending application for Letters Patent filed the 8th day of August, 1901, Serial No. 71,372, is illustrated by the accompanying drawings, in which—

Figure 1 is a view partly in section and partly in elevation, and Fig. 2 a cross-sectional view.

In applying my invention to the separation of metallic and earthy or rocky ingredients of ore I prefer to mix with the powdered ore from five to ten times its weight of water, forming a thin freely-flowing pulp, which I allow to flow into the mixer A through a pipe D. Into this mixer I also admit a thin stream of oil from a pipe E, provided with a regulating-valve, and a small quantity of acid from a pipe Q, also provided with a regulating-valve. The oil and acid are mixed with the pulp by the rotating beater C. The oil by its selective action coats or absorbs the metallic particles, sulfids, the tellurids, and the like. If plumbago, elementary sulfur, or other substances of like character are present, the oil attaches itself to or coats such particles, while it does not coat or attach itself to the rocky or earthy particles present. The liquid mineral pulp, oil, and acid are caused to travel along the mixer A and become thoroughly mixed. This mixture issues by an opening F into a subsidence-tank G, which has in its upper part a partition H, extending down a little below the level of an outlet-pipe I. In the tank G a separation takes place of the metallic from the rocky or earthy ingredients of the mixture, the metallic ingredients adhering to the oil and by it floated to the top on the left side of the partition H, while the earthy and rocky ingredients subside and are allowed to issue through a pipe J, provided with a regulating-cock. The metallic ingredients, with the oil and acid, are discharged by the pipe I into the drum K of a centrifugal machine which revolves rapidly in a casing L. The drum has an inwardly-projecting flange M at its upper edge. As the drum revolves the metallic matters, owing to their density, accumulate in an annular layer at the circumference of the drum, while the oil

and acid collect inside and flow over the flange M into the casing L, whence they are conducted away through a pipe N. From time to time the revolution of the drum is stopped and the metallic matter removed.

Having thus described the nature of this invention and the best means I know of carrying the same into practical effect, I claim—

The process for separating metallic and rocky constituents of ore which consists in mixing pulverized ore with water and mixing the ore and water with oil in the presence of an acid, allowing the mixture to rest whereby the oil having the metallic substances entrapped in it floats at the top of the mixture, and separating the metallic constituents from the oil, substantially as described.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses

ALEXANDER STANLEY ELMORE.

Witnesses:
GERALD L. SMITH,
W. M. HARRIS.

No. 892,643. Patented Feb. 4, 1902.

A. S. ELMORE.

APPARATUS FOR SEPARATING MINERALS BY SELECTIVE ACTION OF OILS.

(Application filed Aug. 8, 1901.)

(No Model.)

2000

Fig. 2.

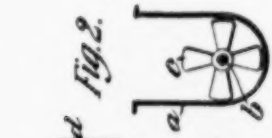
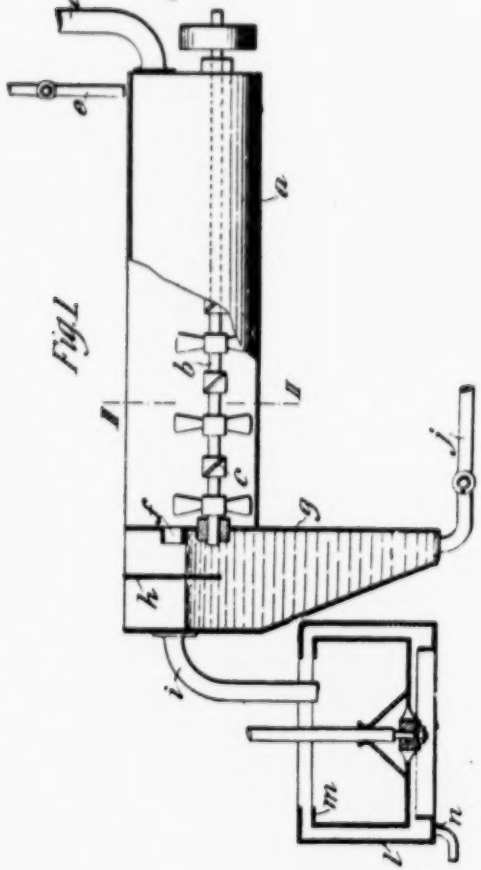


Fig. 1.



Witnesses
Howard Elmore

Inventor
Edmund S. Elmore
by James Lo. Norris
Atty

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UNITED STATES PATENT OFFICE.

ALEXANDER S. ELMORE, OF LONDON, ENGLAND.

APPARATUS FOR SEPARATING MINERALS BY SELECTIVE ACTION OF OILS.

SPECIFICATION forming part of Letters Patent No. 692,643, dated February 4, 1902.

Application filed August 8, 1901. Serial No. 71,372. (No model.)

To all whom it may concern:

Be it known that I, ALEXANDER STANLEY ELMORE, a citizen of England, residing at 4 Bishopsgate street within, in the city of London, England, have invented a certain new and useful Apparatus for Separating Minerals by the Selective Action of Oils, of which the following is a specification.

This invention relates to apparatus for effecting the separation of minerals by the selective action of oils, as I shall describe, referring to the accompanying drawings.

Figure 1 is an elevation, partly sectional, of apparatus according to my invention. Fig. 2 is a transverse section on the line II II of Fig. 1.

a is a trough having a rounded bottom, in which a shaft *b*, carrying a number of inclined agitating-blades *c*, is caused to revolve by any suitable power. Into one end of the trough leads a pipe *d*, by which pulverized ore or mineral mixed with five to ten times its volume of water is fed into the trough, while oil is fed by a pipe *e* in quantity regulated by a cock. As the liquid mineral pulp and oil are caused by the blades *c* to travel along the trough *a* they become thoroughly mixed, and the mixture issues by an opening *f* into a subsidence-tank *g*, which has in its upper part a partition *h*, extending down a little below the level of an outlet-pipe *i*. In the tank *g* a separation takes place of the metallic from the rocky or earthy ingredients of the mixture, the metallic ingredients adhering to the oil and by it floated to the top on the left side of the partition *h*, while the earthy and rocky ingredients subside and are allowed to issue by a pipe *j*, provided with a regulating-cock. The metallic ingredients, with the oil, are discharged by the pipe *i* into the drum *k* of a centrifugal machine, which revolves rapidly in a casing *l*. The drum *k* has an inwardly-projecting flange *m* at its upper edge. As the drum revolves the metallic matters, owing to their density accumulate in an annular layer at the circumference of the drum, while the oil collects inside them and overflows over the flange *m* into the casing *l*, whence it flows by a pipe *n*. From time to time the revolution of the drum is stopped and the metallic matter is removed from it.

Having thus described the nature of this invention and the best means I know of carrying the same into practical effect, I claim—

The combination in an apparatus for separating metallic from rocky constituents of ore, of a trough, a shaft adapted to revolve within said trough and provided with inclined blades, pipes for delivering oil and water to said trough, a subsidence-tank arranged at one end of said trough, extending below the same and communicating therewith, said tank adapted to receive the liquid mineral pulp and oil from said trough, a vertically-extending partition arranged in said tank at the top thereof for the purpose set forth, a centrifugal drum arranged at one side of said tank, a pipe connected to said tank and communicating with said drum for discharging therein the metallic ingredients and the oil, and a pipe connected to the tank for discharging therefrom the earthy and rocky ingredients.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

A. S. ELMORE.

Witnesses:
WALTER JAMES SKERTEN,
GERALD L. SMITH.

No. 729,805. PATENTED JUNE 2, 1903.

J. & L. STOVEKEN.

APPARATUS FOR EXTRACTING METALS FROM ORES.

APPLICATION FILED AUG 12, 1902.

NO MODEL. 5 SHEETS—SHEET 1.

2008

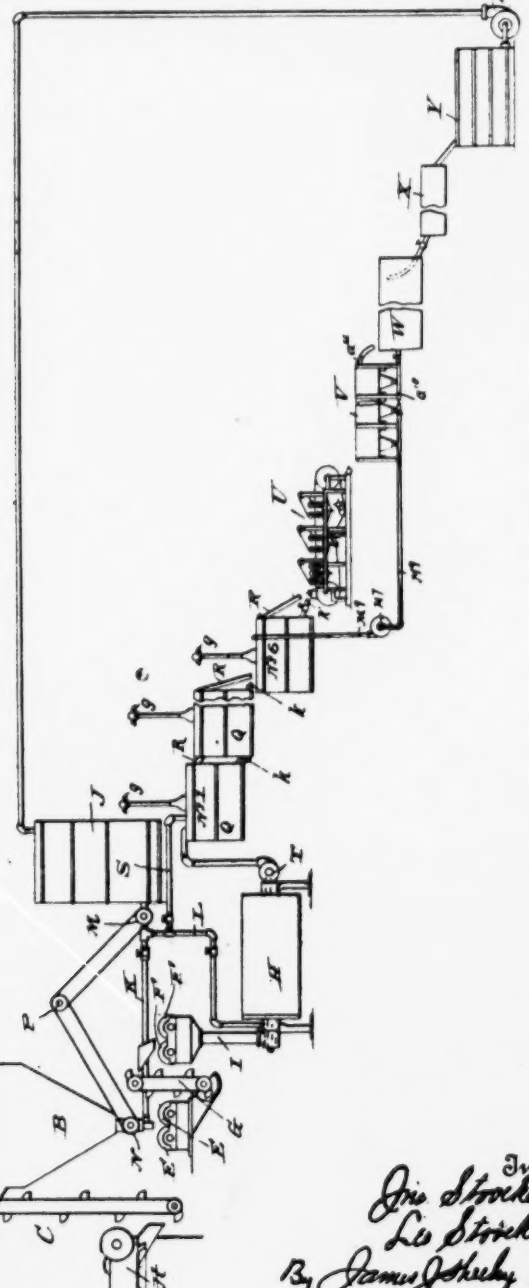

Fig. 1.

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APPARATUS FOR EXTRACTING METALS FROM ORES.

APPLICATION FILED AUG. 12, 1902.

NO MODEL. 6 SHEETS—SHEET 2.

Fig. 2.

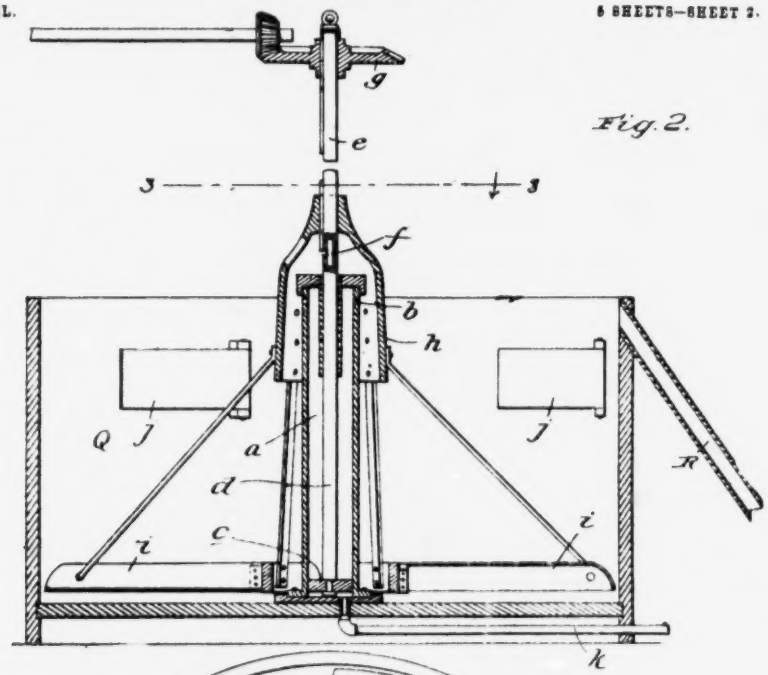
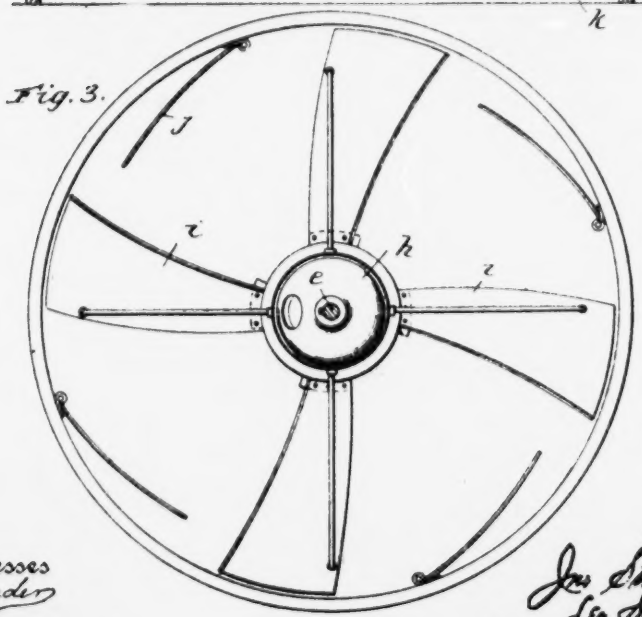


Fig. 3.



Witnesses
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79—Rec.

No. 729,805 PATENTED JUNE 2, 1903.

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APPARATUS FOR EXTRACTING METALS FROM ORES.

APPLICATION FILED AUG. 12, 1902.

NO MODEL. 6 SHEETS—SHEET 3.

Fig. 4.

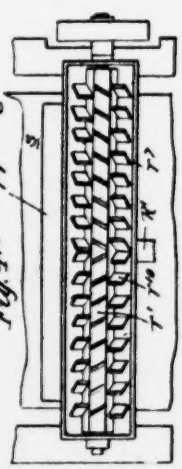

Fig. 4a.

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APPARATUS FOR EXTRACTING METALS FROM ORES.

2101

APPLICATION FILED AUG. 12, 1902

NO MODEL. 5 SHEETS—SHEET 4.

Fig. 5.

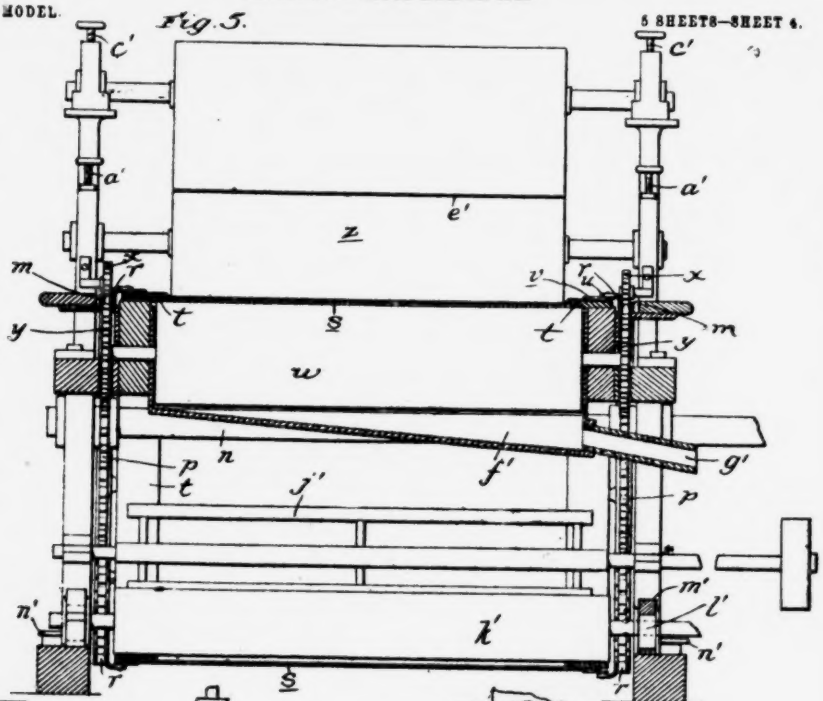


Fig. 6.

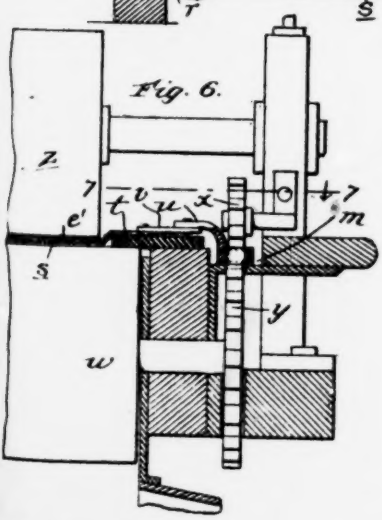
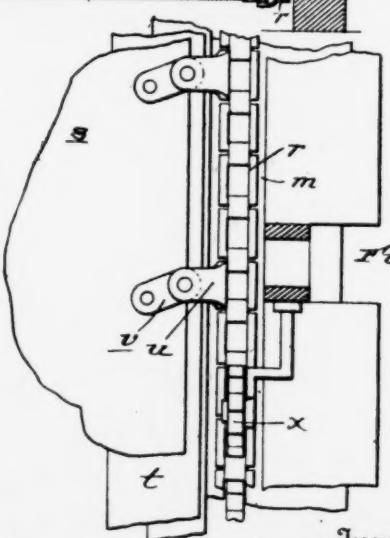


Fig. 7.



Witnesses
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2102

PATENTED JUNE 2, 1903.

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APPARATUS FOR EXTRACTING METALS FROM ORES.

APPLICATION FILED AUG. 12, 1902.

NO MODEL. No. 729,[illegible]95. 5 SHEETS—SHEET 5

Fig. 8.

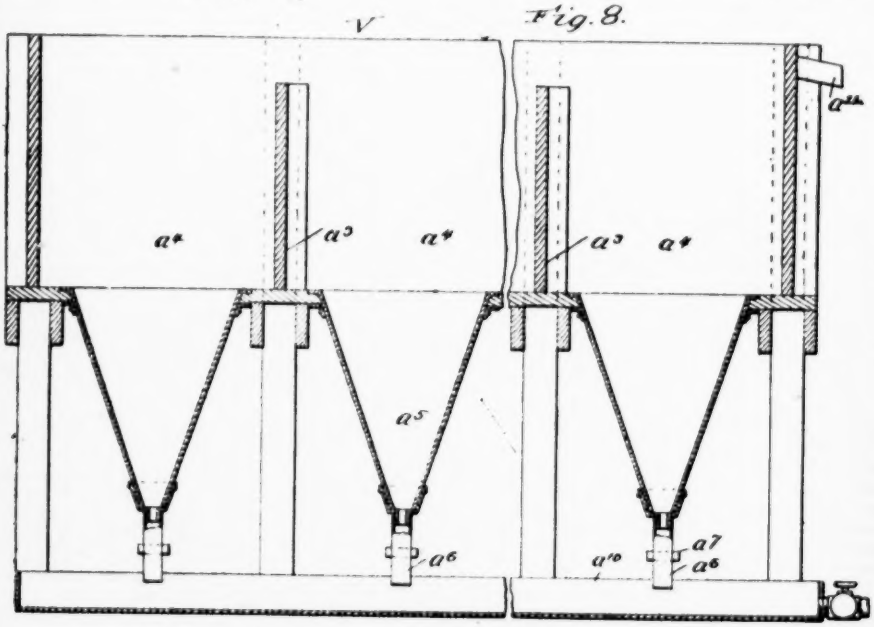
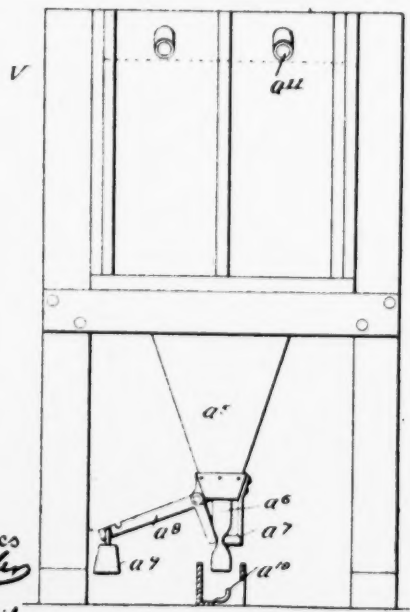


Fig. 9.



Witnesses
[illegible]
[illegible]

Inventors
Jno. Stoveken
Leo Stoveken
By James J. Shelby Attorney

No. 729,805. Patented June 2, 1903.

UNITED STATES PATENT OFFICE.

JOHN STOVEKEN, OF CRIPPLECREEK, AND LEO STOVEKEN, OF FLORENCE, COLORADO.

APPARATUS FOR EXTRACTING METALS FROM ORES.

SPECIFICATION forming part of Letters Patent No. 729,805, dated June 2, 1903.

Application filed August 12, 1902. Serial No. 119,433. (No model.)

To all whom it may concern:

Be it known that we, JOHN STOVEKEN, residing at Cripplecreek, in the county of Teller, and LEO STOVEKEN, residing at Florence, in the county of Fremont, State of Colorado, citizens of the United States, have invented new and useful Improvements in Apparatus for Extracting Metals from Their Ores, of which the following is a specification.

Our invention relates to apparatus for extracting precious metals from their ores; and it has for its general object to provide an apparatus designed more especially for the treatment of ores in which only a small percentage can be saved by amalgamation and which ores are of too low grade to be treated by barrel chlorination and too clayey or slimy to be percolated by cyanid solution.

The invention will be fully understood from the following description and claims when taken in conjunction with the accompanying drawings, in which—

Figure 1 is a broken side elevation of the apparatus constituting the preferred embodiment of our invention; Fig. 2, an enlarged diametrical section of one of the agitation-tanks forming part of the apparatus; Fig. 3, a section taken in the plane indicated by the broken line 3 3 of Fig. 2 looking downwardly; Fig. 4, an enlarged side elevation of the filter forming part of the apparatus; Fig. 4ª, a detailed plan view of the spreader comprised in the filter; Fig. 5, a slightly-enlarged transverse section taken on the broken line 5 5 of Fig. 4; Fig. 6, an enlarged detail section taken on the broken line 6 6 of Fig. 4; Fig. 7, a detail horizontal section taken in the plane of the broken line 7 7 of Fig. 6 looking downwardly; Fig. 8, a broken longitudinal vertical section of the decanting-vat forming part of the apparatus, and Fig. 9 an end elevation of the same with a portion of the trough broken away.

Similar letters of reference designate corresponding parts in all of the several views of the drawings, referring to which—

A, Fig. 1, is an ore-crusher, which may be of any suitable description; B, a bin for containing crushed ore; C, an elevator for transferring the crushed ore from the crusher to the bin D, a sampler which is preferably employed, but which *per se* forms no part of our invention and may therefore be omitted when desired; E E, rolls disposed below the discharge of the bin B and having for their purpose to reduce the size of the pieces of ore; F F, rolls, the purpose of which is to further reduce the size of the pieces of ore; G, an endless elevator arranged to receive the ore as it comes from the rolls E and transfer it to the rolls F; H, a pulverizer, preferably a ball-pulverizer, which has for its purpose to reduce the ore to a finely-divided or comminuted state; I, a conduit for conducting the ore from the discharge of the rolls F to the pulverizer; J, a tank for containing the cyanid solution or other solvent used in the operation of the apparatus; K, a conduit, preferably valved, which leads from the tank J and has discharges disposed over the rolls E and F, this to effect a mixture of the solution and ore incident to the grinding of the latter by said rolls; L, a conduit, preferably valved, which leads from the conduit K to the pulverizer H and has for its purpose to supply solution to the pulverizer, and thereby assure the ore being ground exceedingly fine in the presence of the solution; M, a measuring device or meter of any suitable description arranged in the conduit K between the solution-tank J and the conduit L; N, an ore-feeding device of any suitable description controlling the discharge of the bin B; P, a counter-shaft from which the pump M and the ore-feeding device N are driven, this to assure a supply of solution to the rolls E and F and the pulverizer H commensurate with the quantity of ore discharged from the bin B; Q Q, agitation-tanks, of which six are preferably employed, said tanks being arranged one below the other and being provided with discharge-conduits R, so as to enable the mixed solution and comminuted ore to flow by gravity from the tank nearest the pulverizer H to the next lower tank, and so on until they reach the last tank—*i. e.*, the lowest tank and that farthest from the pulverizer, from which they flow to the filter, presently described; S, a conduit, preferably valved, leading from the conduit L to the agitation-tank No. 1—*i. e.*, the uppermost tank of the series—and designed to supply said tank with the cyanid or other solution

employed; T, a suitable sand-pump interposed between and connected to the pulverizer H and the agitation-tank No. 1 and having for its purpose to move the solution and comminuted ore from the former to the latter; U, a filter arranged to receive the comminuted ore and solution from the last of the agitation-tanks Q—*i. e.*, tank No. 6—and having for its purpose to separate the solution from the pulp; V, a decanting-vat comprising a plurality of separate tanks designed to receive separate solutions from the filter U; W, one or more gold-tanks—*i. e.*, storage-tanks for the gold solution—arranged to receive from the vat V; X, one or more zinc boxes—*i. e.*, boxes arranged to receive from the tank or tanks W and filled with zinc shavings, on which the gold precipitates; Y, a sump-tank or plurality of tanks arranged to receive solution from the zinc box or boxes, and Z a centrifugal or other suitable pump connected with the sump tank or tanks and the tank J and designed to transfer the solution from the former to the latter. When the solution is thus returned to the tank J and cyanid is added thereto, the solution is used again. This materially lessens the cost of operating the apparatus and is advantageous for such reason.

The ore-crusher A, the elevator C, the grinding-rolls E and F, the elevator G, the pulverizer H, the counter-shaft P, the shafts, presently described, of the agitation-tanks Q, the sand-pump T, the filter U, and the pump Z are driven by a suitable motor or motors through the medium of suitable driving connections, which *per se* form no part of our invention and which we have therefore deemed it unnecessary to illustrate.

In the practical operation of our apparatus it will be observed that the solution is in contact with the ore incident to the grinding of the ore by the rolls E and F and incident to the reduction of the ore to a finely divided or comminuted state in the pulverizer H. By virtue of this and the subsequent violent agitation of the comminuted ore and solution in the tanks Q the solution reaches all of the values no matter how small the particles of ore in which the same are contained, with the result that when but a weak cyanid solution or other solvent is employed an extraction of from ninety-five per cent. to ninety-eight per cent. of values is effected in from two to six hours, and this without any subsequent concentration of the tailings. The reduction of the ore to a finely divided or comminuted state—*i. e.*, a pulverized state—in the presence of the solution employed assures the solution contacting with every particle of ore, as stated, and thereby accelerates the extraction of the values, and it is also advantageous since less power is required to grind wet ore than dry ore and because it does away with dust and lessens the wear and tear on the machinery. It will also be observed that the ore reduced to a pulverized state and the solution commingled therewith pass continuously and freely through the apparatus, which contributes materially to the thorough extraction of values from the ore. In this connection we desire it understood that we do not confine ourselves to the means shown and described for reducing the ore to a comminuted state in the presence of the solution employed, as any means may be employed for this purpose without involving a departure from the scope of our invention.

From the last of the agitation-tanks—*i. e.*, tank No. 6—the comminuted ore and solution pass to the filter U, where the solution is separated from the pulp and washes are applied to the latter to produce weaker solutions. The pulp is discharged from the filter as tailings, while the solutions separated from the pulp are piped or otherwise conducted to separate tanks of the vat V. Here the slimes in suspension are allowed to settle and are drawn off at the lower ends of the decanting-tanks, while the clear solution flows off at one end and adjacent to the top of the vat V and is led to the precipitating-tank.

Having described the general construction and operation of our improved apparatus, we will now proceed to a detailed description of the agitation-tanks Q, filter U, and decanting-vat V.

The tanks Q are similar in construction, and hence a detailed description of the one shown in Figs. 2 and 3 will suffice to impart an understanding of all. Referring therefore to Figs. 2 and 3, *a* is a cylinder fixed in the center of the tank Q and having a vent *b* adjacent to its upper end; *c*, a piston movable vertically in the cylinder and having a rod *d* extending through the upper end or head thereof; *e*, a shaft connected by a step *f* or other means with the rod *d*, so as to enable it to move vertically with and rotate independently of said rod *d*; *g*, a miter-gear to which the shaft *e* is keyed or feathered and through which said shaft is adapted to move vertically; *h*, a head connected to the shaft *e*, so as to turn and move vertically therewith; *i i*, agitating-blades connected together and to the head *h* and curved in the direction of their length and inclined in the direction of their width, Figs. 2 and 3, whereby they are adapted to throw the comminuted ore and solution outward after the manner of a centrifugal pump and upward like a plow; *j j*, stationary wings connected to the side wall of the tank and having for their purpose to force the mixture of comminuted ore and solution back to the center of the tank when the same is thrown outwardly by the blades *i*, and *k* a pipe let into the cylinder *a* below the piston *c* and designed, in common with the pipes *k* of the other cylinders Q, to be connected with a source of fluid-pressure supply. When the shaft *e* is rotated by a driving connection intermeshed with the miter-gear *g*, it will be observed that the material in the tank will be thrown outwardly and upwardly against the

wings *f*, which will roll it back into the center of the tank. This is materially advantageous, since in addition to being kept in suspension the material is worked up and down, and consequently the cyanid solution is caused to absorb the necessary oxygen and effect a rapid and complete dissolution of the gold and silver contained in the ore.

It is desirable in the event of a stop in the operation to raise the agitator means—that is, the blades *i* and the parts to which they are connected—of the several tanks Q out of the mixture or pulp therein. This, in virtue of our improvements, may be accomplished by an attendant opening a valve (not shown) controlling communication between a source of fluid-pressure supply and the pipes *k*, for it will be seen that when fluid-pressure is let into the cylinders *a* of the tanks Q the pistons *c*, shafts *e*, and agitators *i* of said tanks will be raised. To lower the agitators into the mixture or material in the several tanks, the attendant has but to open a bleeder (also not shown) connected with the pipes *k*, when the agitators will gravitate or settle down into the working position. (Shown in Fig. 2.)

It will be appreciated from the foregoing that both the raising and lowering of the agitators in the tanks Q may be quickly and easily effected without involving effort on the part of the attendant of the apparatus, which is a desideratum.

The filter U is best shown in Figs. 4 to 7, referring to which *l* is the main frame of the filter, which preferably comprises a base and two longitudinal uprights and is provided at the upper sides of the latter with parallel longitudinal ways *m*, Figs. 5 to 7; *n n*, transverse shafts journaled in the uprights of the frame at the ends thereof and equipped with sprocket-wheels *p*, arranged in alinement with the ways *m*; *r r*, sprocket-chains mounted on the wheels *p* and having their upper stretches disposed in the ways *m*; *s*, an endless filter-cloth; *t t*, endless strips of rubber or other suitable material secured to the inner side of the cloth *s* at the edges thereof and having for their purpose to bear on the upper edges of the longitudinal frame-uprights, and thereby prevent frictional wear of the cloth; *u u*, arms connected to the chains *r* at intervals in the length thereof and extending inwardly therefrom; *v v*, links which connect the filter-cloth and rubber belts to the arms *u*; *w w*, transverse rolls of wood or other suitable material mounted in the frame-uprights below the upper stretch of the filter-cloth and arranged, by preference, in three sets, as best shown in Fig. 4; *x x*, idler sprocket-wheels disposed above and in engagement with the upper stretches of the chains *r* and having for their purpose to hold the chains down on sprocket-gears *y* on the rolls *w*, so as to assure the rotation of the rolls in the direction indicated by arrow by the chains; *z z*, transverse rolls arranged in three sets above the rolls *w* and the upper stretch of the filter-cloth *s* and designed to be pressed by screws *a'* or other means toward the filter-cloth; *b b'*, rolls, one of which is employed in conjunction with each set of rolls *z*; *c c'*, screws, the purpose of which is to hold the upper bearing-blocks of the rolls *b'* on the lower slidable bearing-blocks thereof; *d' d'*, screws for adjusting the bearings of the rolls *b'* in the direction of the length of the filter and adjustably fixing the same in position; *e' e'*, belts of rubber or other suitable material passed around the rolls *z* and *b'* and having their lower stretches arranged in frictional contact with the filter-cloth *s*; *f' f'*, receptacles arranged under the three sets of rolls *w* and designed to be connected by pipes *g'* with the separate decanting-tanks of the vat V; *h' h'*, pipes designed to be connected with a source of water-supply and arranged to spray water against the stretches of the rubber belts *e'* between the filter-cloth *s* and the rolls *b'*; *i' i'*, pipes arranged to spray water against the lower stretch of the filter-cloth *s*; *j'*, a rotary beater arranged adjacent to the pipes *i'* and adapted to engage the lower stretch of the cloth *s*; *k'* a transverse roller arranged above the lower stretch of the cloth *s* and adjacent to the beater and having its ends journaled in disks *l'* off the center thereof, the disks being arranged in straps *m'* and provided with handles *n'*; *p'*, a transverse roll arranged below the lower stretch of the cloth *s*; *q'*, a weighted transverse roll arranged above the lower stretch of the cloth *s* and having for its purpose to squeeze the same against the roll *p'*, and *r'* a rotatable spreader arranged above the upper stretch of the cloth *s* at the receiving end of the filter. One of the shafts *n* of the filter is designed to be driven by a suitable motor, (not shown,) while the beater *j'* is preferably driven from an overhead counter-shaft. (Also not shown.)

The operation of the filter U in detail is as follows: The chains *r* and filter-cloth *s* are driven in the direction indicated by arrow and the beater *j'* is rotated. The rubber belts *e'* are driven in the direction indicated by arrow by the friction between them and the filter-cloth. The pulp and solution are discharged from the last agitation-tank—*i. e.*, tank No. 6—through pipe R into the spreader, which has flights extending right and left from the center and is consequently adapted to keep the pulp and solution mixed and spread the same uniformly across the filter-cloth. The filter-cloth carries the mixed pulp and solution under the first set of press-rolls *z*, where the first rubber belt *e'* presses the solution through the filter-cloth. This solution, which is strong, is received in the first receptacle *f'* and is carried by the pipe *g'* to one of the decanting-tanks of the vat V. As it leaves the first set of press-rolls most of the pulp adheres to the first belt *e'*. It is, however, washed down to the cloth by the spray of water from the adjacent pipe *h'*,

which also dilutes the values left as moisture in the pulp. The mixed pulp and water then passes under the second set of press-rolls z, where the second belt e passes the solution, which is of medium strength, through the filter-cloth. This solution is received in the second receptacle f' and conducted by the pipe g' thereof to a tank of the vat V separate from that in which the first solution is placed. In leaving the second set of press-rolls the pulp is watered by the pipes h' adjacent to the second belt e', and the pulp and water are carried below the third set of press-rolls. Here the weak solution, produced by the mixture of pulp and water, is pressed through the cloth s and received in the third receptacle f', from whence it is conducted by the pipe g', complementary to said receptacle, to a separate tank of the vat V. After leaving the third set of press-rolls the pulp is forced from the cloth by the water discharged by the pipes i' and the beater j' and is discharged as tailings from the filter through a launder a^2, which may extend to a dump or any other point. After being acted on by the beater j' the cloth s passes between the squeeze-rolls p' q', which serve to press the water from the cloth, with the result that the same returns to the receiving end of the filter in a clean and dry state. By turning the disks l', and thereby raising or lowering the roller k', the filter-cloth is carried toward or from the beater j' to increase or diminish the action of the beater on the cloth.

It will be readily appreciated from the foregoing that the construction of our improved filter is such that the slimes are effectually prevented from collecting and packing down on the filter-cloth and preventing the passage of the solutions therethrough, also that by virtue of the chains traveling in ways or grooves in the frame and being connected to the filter-cloth the filter-cloth is spread out and always held in proper position with respect to the press-rolls and belts e', which conduces to the thorough separation of the solution from the pulp.

As best shown in Fig. 8, the vat V is divided by transverse partition-walls a^3 into a plurality of separate decanting-tanks a^4. These tanks are designed to receive the solutions from the receptacles f' of the filter U, and each of them is provided at its lower end with a steep funnel a^5, which is provided in turn at its lower end with a hose a^6. The hose of each tank is normally closed by a clamp, Fig. 9, which comprises a fixed member a^7, connected to the funnel and disposed at one side of the hose, and a pivoted member a^8, connected to the funnel and disposed at the opposite side of the hose with reference to the member a^7 and normally held in the position shown by a weight a^9. When the solutions from the filter U are led into the tanks a^4 of the vat V, the slimes settle into the funnels a^5 and are drawn off at intervals into a trough a^{10}, while the clear solution passes through one or more conduits a^{11} at one end of the vat to the gold-tank W. When desirable, the members a^8 of the clamps of the several tanks a^4 may be connected together, so that all of the clamps may be opened in concert and slimes discharged from all of the tanks at one time.

The construction described for controlling the discharge of slimes from each of the decanting-tanks is materially advantageous, since there is no liability of the pulp choking the hose, the opening and closing of the hose serving to keep the pulp loose.

We prefer in practice to use a pump M^2 and a conduit M^3 to return the slimes discharged from the tanks a^4 to the lowermost of the agitation-tanks or to the filter, this in order to pass the slimes through the filter the second time and recover the solution contained therein. The conduit M^3 preferably leads from the receptacle or trough a^{10} to the pump M^2 and thence to the lowermost agitation-tank, as shown in Fig. 1.

It will be appreciated from the foregoing that in virtue of the fine grinding our improved apparatus will treat to advantage high or low grade pyritic and telluride ores without a preliminary roast, as the fine grinding frees the particles of gold inclosed in the pyrites and renders the telluride and other compounds of gold more amenable to the cyanid solution.

The spreader r' is arranged in a box r^2, which preferably has an apron r^3. The spreader is a six-sided shaft having wooden flights or wings r^{10} on its sides, the wings at one side of the center of the shaft being inclined oppositely to those at the opposite side of the center. The spreader is driven by belt from an overhead counter-shaft. (Not shown.)

We have entered into a detailed description of the construction and relative arrangement of the parts embraced in the present and preferred embodiment of our invention in order to impart a full, clear, and exact understanding of the same. We do not desire, however, to be understood as confining ourselves to such specific construction and relative arrangement of parts, as such changes or modifications may be made in practice as fairly fall within the scope of our invention as claimed.

Having described our invention, what we claim, and desire to secure by Letters Patent, is—

1. In an apparatus for extracting precious metals from their ores, means whereby ore is reduced to a finely-divided or comminuted state in the presence of a solvent, a series of overflow-tanks arranged to receive the mixed ore and solvent from the reduction means; said tanks containing means for agitating the ore and solvent, and a filter arranged to receive the mixed ore and solvent from the last of the overflow-tanks, and adapted to separate the solution from the ore.

2. In an apparatus for extracting precious metals from their ores, means for reducing ore to a finely-divided or comminuted state, means for supplying a cyanid or other suitable solution to the ore incident to the said reduction thereof, a series of overflow-tanks arranged to receive the mixed ore and solution from the reduction means, and equipped with means for agitating the ore and solution, means for supplying solution alone to the first of said tanks, and a filter arranged to receive the mixed ore and solution from the last of the tanks, and adapted to separate the solution from the ore.

3. In an apparatus for extracting precious metals from their ores, the combination of a tank for containing a cyanid or other suitable solution, means for reducing ore to a finely-divided or comminuted state, one or more conduits connected with the solution-tank and arranged to supply the ore with solution incident to the reduction thereof, means for agitating and mixing the ore and solution, arranged to receive the same from the reduction means, a filter arranged to receive the ore and solution from the agitating and mixing means, and adapted to separate the solution from the ore, one or more decanting-tanks arranged to receive the solution or solutions from the filter, a precipitating-tank which receives the clear solution from the decanting tank or tanks, and means for transferring the solution from the precipitating-tank back to the solution-tank.

4. In an apparatus for extracting precious metals from their ores, the combination of an ore-bin, an ore-feeding device controlling the discharge of the bin, means for reducing ore to a finely-divided or comminuted state, arranged to receive from the bin, a tank for containing a cyanid or other suitable solution, a conduit connected with said tank and arranged to supply the ore with solution incident to the reduction thereof, a measuring device controlling said conduit, and a common means for actuating the ore-feeding device and the solution-measuring device.

5. In an apparatus for extracting precious metals from their ores, the combination of an ore-bin, an ore-feeding device controlling the discharge of the bin, means for reducing ore to a finely-divided or comminuted state, arranged to receive from the bin, a tank for containing a cyanid or other suitable solution, a conduit connected with said tank and arranged to supply the ore with solution incident to the reduction thereof, a measuring device controlling said conduit, a common means for actuating the ore-feeding device and the solution-measuring device, a series of overflow-tanks containing means for agitating and mixing the ore and solution, a conduit for conveying solution to the first of the overflow-tanks, a pump arranged to raise ore and solution from the reduction means to the first of the overflow-tanks, a filter arranged to receive ore and solution from the last of the overflow-tanks, and separate the solution from the ore, one or more decanting-tanks arranged to receive a solution or solutions from the filter, a precipitating-tank which receives the clear solution from the decanting tank or tanks, and means for transferring the solution from the precipitating-tank back to the solution-tank.

6. In an apparatus for extracting precious metals from their ores, the combination of an ore-bin, means for reducing ore to a crushed state, arranged to receive from the bin, means for controlling the discharge of ore from the bin, a tank for containing a cyanid or other suitable solution, a conduit connected to the tank and arranged to supply the ore with solution incident to the reduction thereof, means for controlling the passage of solution through said conduit, and a common means for operating the means for controlling the discharge of the ore from the bin, and the means for controlling the passage of the solution through the conduit, whereby the supply of solution is commensurate with the supply of ore.

7. In an apparatus for extracting precious metals from their ores, means whereby ore is reduced to a pulverized state in the presence of a solvent, means for agitating the mixed ore and solvent, means for separating the solution from the ore, decanting means for receiving the solution from the separating means, and a precipitating-tank for receiving solution from the decanting means.

8. In an apparatus for extracting precious metals from their ores, a solvent source of supply, means whereby ore is reduced to a pulverized state in the presence of solvent from the source of supply, means for agitating the mixed ore and solvent, means for separating the solution from the ore, decanting means for receiving the solution from the separating means, a precipitating-tank for receiving solution from the decanting means, and means for conducting the solution to the source of supply.

9. In an apparatus for extracting precious metals from their ores, means for separating solution from ore, decanting means receiving solution from the separating means, and means for returning slimes from the decanting means to the separating means.

10. In an apparatus for extracting precious metals from their ores, the combination of means for separating solutions from mixed ore and solvent, and separate decanting devices for receiving the solutions from the separating means.

In testimony whereof we have hereunto set our hands in presence of two subscribing witnesses.

JOHN STOVEKEN.
LEO STOVEKEN.

Witnesses:
WM. H. TABOR,
JAMES A. MCCANDLESS.

No. 735,071. PATENTED AUG. 4, 1903.

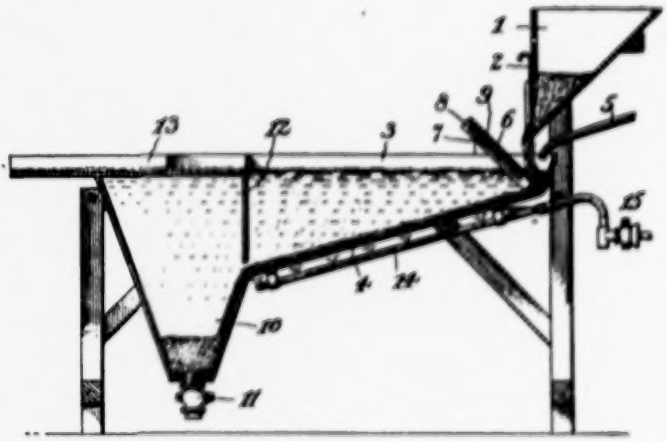
G. D. DELPRAT.

EXTRACTION OF ZINC, LEAD, AND SILVER SULFIDS FROM THEIR ORES.

APPLICATION FILED JAN. 8, 1900.

NO MODEL.

2108



Witnesses:
C. H. Ober
M. E. Beall

Inventor
Guillaume Samuel Delprat,
by Henry Orth & Co.
Atys.

2169

UNITED STATES PATENT OFFICE

GUILLAUME D. DELPRAT, OF BROKEN HILL, NEW SOUTH WALES, AUSTRALIA.

EXTRACTION OF ZINC, LEAD, AND SILVER SULFIDS FROM THEIR ORES.

SPECIFICATION forming part of Letters Patent No. 735,071, dated August 4, 1903.

Application filed January 2, 1903. Serial No. 137,888. (No specimens.)

To all whom it may concern:

Be it known that I, GUILLAUME DANIEL DELPRAT, general manager of the mines and works of the Broken Hill Proprietary Company, Limited, of Victoria, a subject of the Queen of the Netherlands, residing at Broken Hill, in the State of New South Wales and Commonwealth of Australia, have invented new and useful Improvements in the Extraction of Zinc, Lead, and Silver Sulfids from Their Ores, of which the following is a specification.

This invention relates to the extraction or concentration of sulfid ores to separate them from their gangue.

The ore is first finely ground or stamped and then immersed or dropped into a bath or solution, hereinafter described. An apparatus for carrying out the process forms the subject-matter of a separate application, filed March 9, 1903, Serial No. 146,895. This process is readily carried out at ordinary temperatures and depends upon the ore particles being attacked by the acid to form a gas. Each ore particle so attacked will have a bubble or bubbles of gas adhering to it, by means of which it will be floated and can be skimmed or floated off the solution. The particles of the gangue, such as silicates and other substances not quickly or readily attacked by acid or dilute acid, fall to the bottom of the body of the solution and are removed from time to time. To facilitate the floating of the ore particles, suitable salts are added to the solution to increase its specific gravity, as will be hereinafter explained.

In extracting or concentrating, more especially the sulfid ores of zinc, lead, and silver, I make use of a nitric-acid solution, the gravity of which is increased to one and four-tenths, (1.4,) more or less, by the addition of a suitable nitrate, such as an alkaline-metal nitrate, as the nitrate of soda, nitrate of potash, or another metallic nitrate, as the nitrate of zinc dissolved in water, or a mixture of nitrates. The sulfids in the ore are rapidly acted upon by the acid and gas-bubbles formed on them, that quickly carry them to the surface, whence they flow away or are removed by skimming. The tailings or waste may be removed from the bath from time to time, as is necessary or expedient.

The drawing shows in vertical longitudinal section the apparatus used.

Below an ordinary bin or hopper 1, having a regulating discharge-door 2, is the pan or vessel 3, having a sloping bottom 4. The liquor or chemical solution is supplied by pipe 5 from a suitable reservoir (not shown) at an upper level. Just below the door 2 is a plate 6 on pintles or pivots 7 in slots 8, adapted to be clamped by set-screws 9 when the plate is adjusted to the required angle and with the required extent of opening between the lower edge of said plate 6 and the bottom 4, the directing-plate being, primarily, to insure the total immersion of all particles of ore in the fluid or liquor. At the lower end of the inclined bottom 4 is a tailings-receiver or sump 10, having a tailings-discharge 11. At the receiving end of the sump 10 is a baffle-plate 12, extending close to the face of said bottom 4, the object of which is to prevent accumulation of concentrates above the sump 10. Extending from the pan 3 is a launder or trough 13 to receive the overflow and the concentrates. Under the bottom 4 is a piping 14, forming, with the air-inlet cock 15, a Bunsen burner for gas, so that the solution or liquor may be heated, if desired. The ore fed from the hopper 1 drops into the bath and slides by gravity over the bottom to the sump, the ore particles being raised to the surface of the liquor by the gas-bubbles formed, the action of the acid on these ore particles during their travel along the inclined bottom and ore floated off with the overflow through the trough 13, or, if desired, skimmed off.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. The method of separating ores from gangue, which consists in forming a bath containing nitric acid, feeding finely-ground ore thereto, whereby gas-bubbles will be formed on the ore particles to raise them to the surface of the solution, and removing the particles of ore so lifted to the surface, substantially as described.

2110-11

785,071

2. The method of separating ores from gangue, which consists in forming a bath containing nitric acid and a suitable nitrate, feeding finely-ground ore thereto, whereby gas-bubbles will be formed on the ore particles to lift them to the surface and removing the ore particles so raised, substantially as described.

3. The method of separating sulfid ores from their gangue, which consists in forming a bath containing nitric acid, increasing the gravity of the bath by adding thereto the nitrate of an alkaline metal, whereby gas-bubbles will be formed on the ore particles to raise them to the surface, and floating off the particles of ore so raised to the surface, substantially as described.

4. The method of separating sulfid ores from their gangue, which consists in forming a bath containing nitric acid, adding thereto sodium nitrate to increase the specific gravity of the bath, feeding the finely-ground ore into the bath, whereby gas-bubbles will be formed on the surface of the ore particles to raise them to the surface of the bath and floating off the ore particles so raised, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GUILLAUME D. DELPRAT.

Witnesses:

FRED. WALSH,

PERCY NEWELL.

No. 736,381 PATENTED AUG. 18, 1903.

M. F. R. GLOGNER.

PROCESS OF PURIFYING GRAPHITE.

APPLICATION FILED JAN. 27, 1903

NO MODEL.

2112

Fig. 1.

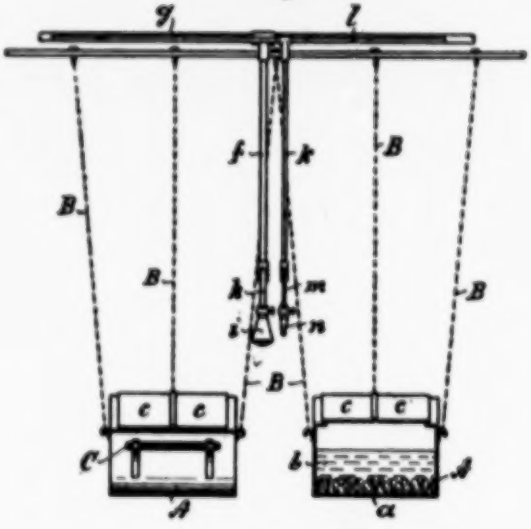
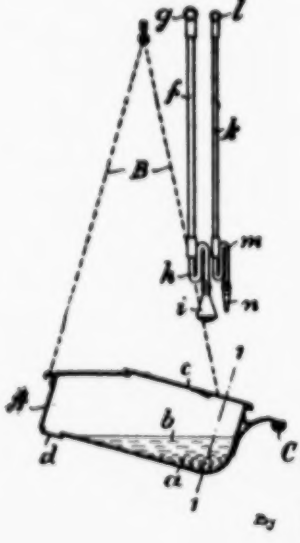


Fig. 2.



Witnesses
N. M. Kuehne
Paul Pennent

Inventor
C. Moritz Friedrich Rudolph Glogner
By Richard Lee
Attorneys

No. 736,381. Patented August 18, 1903.

UNITED STATES PATENT OFFICE.

MORITZ FRIEDRICH REINHOLD GLOGNER, OF FREIBURG, GERMANY.

PROCESS OF PURIFYING GRAPHITE.

SPECIFICATION forming part of Letters Patent No. 736,381, dated August 18, 1903.

Application filed January 27, 1903. Serial No. 140,786. (No specimens.)

To all whom it may concern:

Be it known that I, MORITZ FRIEDRICH REINHOLD GLOGNER, a subject of the King of Prussia, German Emperor, residing at Freiburg, in the Kingdom of Prussia, German Empire, have invented certain new and useful Improvements in Processes of Purifying Graphite; and I do hereby declare that the following is a full, clear, and exact description.

The present invention relates to a process for purifying graphite from its natural mineral impurities, which process is especially adapted to be carried out on a manufacturing scale, because, on the one hand, it is very simple and cheap, and, on the other hand, the final result is very good and far superior to any obtainable by processes hitherto employed.

In my new process after being purified in a first wash from its heavier impurities—as, for instance, quartz, iron, and the like—by means of cold water the graphite mineral is mixed with about three or four times its weight of water to a thin paste. A quantity of petroleum is then added to this paste, which quantity is about half as much as the amount of pure graphite contained in the graphite mixture, and the whole is thoroughly stirred within a closed vessel. Afterward the vessel is allowed to stand, and water is sprinkled over the surface of the liquid by means of a rose or the like in order to obtain a quicker and more complete separation of the graphite particles from the earthy admixtures.

In my present invention I desire first to point out that the graphite mixture as submitted to the process of purification by means of water and petroleum consists, exclusively, of graphite and earthy admixtures. Only by this means is the quick and complete purification of the graphite by means of the subsequent treatment rendered possible. If the graphite were to be purified by means of water and petroleum while the heavier admixtures are still present, a far greater amount of petroleum, as well as of labor, would be necessary, yet a complete separation of the graphite from its admixtures would be impossible. The product obtained thus would not be pure. The high degree of purity, however, determines the value of the product.

For carrying out my new process preferably a plurality of agitating or shaking devices are arranged close to each other, one workman being sufficient for attending four of them

Figure 1 of the accompanying drawings illustrates two agitating devices arranged close to each other, one apparatus being shown in elevation and the other in a section on line 1 1 in Fig. 2. Fig. 2 represents a longitudinal section of an agitating apparatus.

Each agitator A is obliquely suspended on three chains B in such a manner that the wave formed when the vessel is agitated falls back on the higher part of the bottom and a thorough mixing of oil and graphite is obtained, the operation being at the same time facilitated. Each vessel A has a handle C.

a is graphite filled in a wet state.

b is the water with the layer of oil.

c c are covers.

d is an outlet-hole for the pulpy residue—for instance, a hand-hole with a cover, a door, or the like. The tube *f* is in connection with a water-supply *g* and fitted with a flexible tube *h* and a rose *i*. The tube *k* is connected with an oil-supply *l* and also fitted with a flexible tube *m*, leading to a mouthpiece *n*.

The devices are preferably operated by human force, because the treatment of the material is utterly difficult, and a throughout special treatment is required for each of the large number of varieties of the material.

Before the graphite is brought into the vessels A it is separated from its heavier admixtures—as quartz, iron, and the like—which in the well-known manner is effected by washing the material with water in long kennels. Exactly-weighted quantities of the material which thus contains only graphite and earthy admixtures are brought into the vessels A. Then, first water is admitted from the tube *h* and later oil from the tube *m*.

The vessels A are agitated in short shocks, about thirty per minute. After the agitation has taken place the mixture of oil and graphite floating at the surface is subjected to a uniform action of the rose, whereafter the vessel is allowed to stand in order to obtain the separation of the earthy parts. After the attendant has operated four agitators in the described manner the dirty water in the first vessel has become clear in the meantime. The workman takes off the oil-graph-

ite and puts it into a collector for the further treatment in order to obtain in any well-known manner a separation of the oil from the graphite.

The mixture containing only fine earthy substances and graphite is mixed with a quantity of water the weight of which is about three or four times as great as that of the graphite mixture. Petroleum is then added in the approximate proportion of one part petroleum to two parts of graphite contained in the mixture. Now the whole is given a strong rotating, rocking, or reciprocating movement within a closed vessel, so that the mixture is thoroughly stirred and intimately mingled. The petroleum is broken up into very fine drops or perles, and every graphite particle when touching them is attracted, while the earthy particles, which were already saturated with water before the addition of petroleum, remain completely neutral. After the vessel has been allowed to stand the earthy parts sink down, while the petroleum carrying the graphite tends to rise to the surface. After a certain time water is then sprinkled over the surface of the liquid by means of a rose or the like, whereby the fine earthy particles are caused to sink more quickly, and any earthy particles which may be carried upward by the rising petroleum and froth are caused to sink down again.

The vessel is shaken once, twice, or repeatedly after the graphite has been skimmed, and every time some petroleum is added. The whole of the graphite will then be taken off by the petroleum.

In the described manner the graphite is quickly, well, and cleanly separated from its earthy admixtures. The product obtained is of best quality and purity, yet the amount of petroleum and labor needed is insignificant. It is even rendered possible by my process to work graphite mixtures which only contain ten per cent. graphite and to obtain from them a product which is as valuable as the Ceylon graphite.

My new process is furthermore especially adapted for the purification of the small dense crystalline varieties of graphite, for which a commercial purifying process has not existed up to the present time.

Having now described my invention and in what manner the same is to be performed, what I claim, and desire to secure by Letters Patent, is—

A process for purifying graphite in a wet and cold manner by the use of water and petroleum, consisting in the following operations: purifying the graphite mineral from its heavy admixtures (as for instance quartz, iron and the like) by a washing with cold water; mixing said purified graphite mineral with about three or four times its weight of cold water; very strongly agitating said paste within a closed vessel after the addition of a quantity of petroleum of about half the weight of the pure graphite contained in the mixture; and then sprinkling water over the surface of the liquid, after the mixture has been allowed to stand, in order to obtain a quicker and more complete separation of the graphite particles from the earthy substances, substantially as described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

MORITZ FREIDRICH REINHOLD OLOGNER.

Witnesses:
ERNST. KRATZ,
ALBERT SCHENK.

No. 745,960. PATENTED DEC. 1, 1903.

I. F. GOOD.

APPARATUS FOR SEPARATING GRAPHITE OR OTHER MATERIALS FROM ASSOCIATED IMPURITIES.

APPLICATION FILED OCT. 1, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

2116

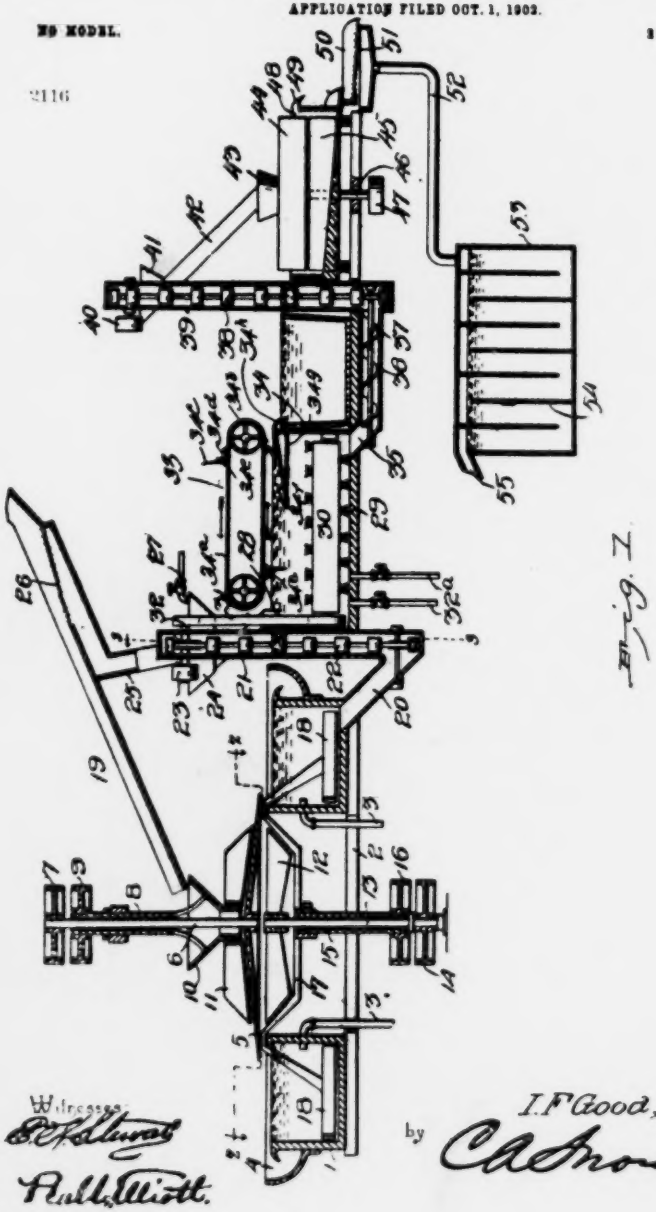


Fig. 1.

Witnesses:
B. F. Stewart
Robt. Elliott.

Inventor
I. F. Good,
by C. A. Snow & Co
Attorneys.

No. 745,960 PATENTED DEC. 1, 1903.

I. F. GOOD

APPARATUS FOR SEPARATING GRAPHITE OR OTHER MATERIALS FROM ASSOCIATED IMPURITIES.

APPLICATION FILED OCT. 1, 1903.

NO MODEL. 2 SHEETS—SHEET 2.

2117

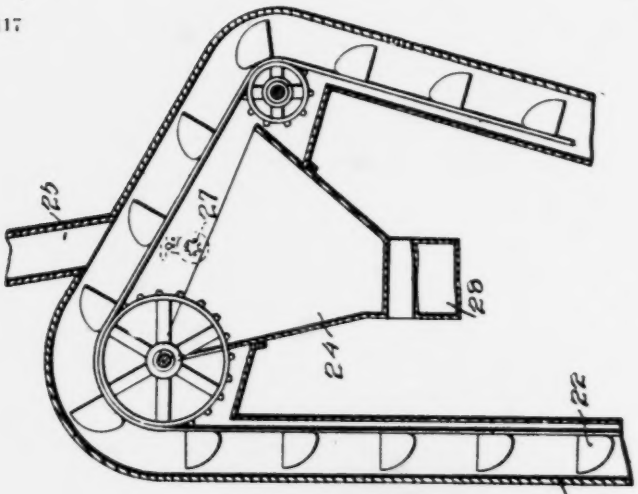


Fig. 3.

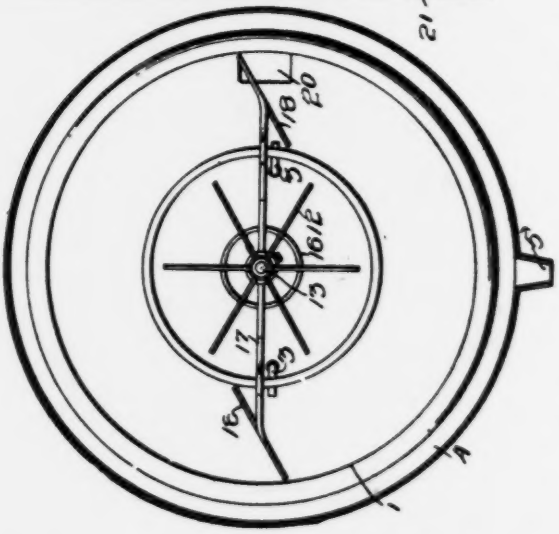


Fig. 2.

Witnesses:
E. P. Stewart
R. M. Elliott

I. F. Good, Inventor:
by C. A. Snow & Co.
Attorneys.

No. 745,960. Patented December 1, 1903.

UNITED STATES PATENT OFFICE.

2118

ISRAEL F. GOOD, OF ALLENTOWN, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO GEORGE FRANCIS PETTINOS, OF BETHLEHEM, PENNSYLVANIA, AND JOHN HERBERT HARRIS, OF ALLENTOWN, PENNSYLVANIA.

APPARATUS FOR SEPARATING GRAPHITE OR OTHER MATERIALS FROM ASSOCIATED IMPURITIES.

SPECIFICATION forming part of Letters Patent No. 745,960, dated December 1, 1903.

Application filed October 1, 1902. Serial No. 125,532. (No model.)

To all whom it may concern:

Be it known that I, ISRAEL F. GOOD, a citizen of the United States, residing at Allentown, in the county of Lehigh and State of Pennsylvania, have invented a new and useful Apparatus for Separating Graphite or other Materials from Associated Impurities, of which the following is a specification.

This invention relates to an apparatus for separating graphite and other materials from associated impurities.

The object of the invention is in a ready, simple, rapid, thoroughly-feasible, and practical manner initially to separate pure graphite from any associated impurities and conserve it and then to effect saving of the bulk of whatever remains in the impurities separated out.

With these and other objects in view, as will appear as the nature of the invention is better understood, the same consists in the novel construction and combination of parts of an apparatus for separating graphite and other materials from associated impurities, as will be hereinafter fully described and claimed.

In the accompanying drawings, forming a part of this specification, and in which like numerals of reference indicate corresponding parts, there is illustrated one form of embodiment of the invention capable of carrying the same into practical operation, it being understood that the elements therein exhibited may be varied or changed as to shape, proportion, and exact manner of assemblage without departing from the spirit thereof.

In the drawings, Figure 1 is a view in vertical longitudinal section through an apparatus constructed in accordance with the present invention. Fig. 2 is a view in longitudinal section taken on the line 2 2 of Fig. 1 and looking in the direction of the arrow thereon. Fig. 3 is a view in sectional elevation, on an enlarged scale, taken on the line 3 3, Fig. 1, showing more particularly the conveying mechnism for elevating the impure materials from the primary separating-tank to the washing mechanism.

Referring to the drawings, 1 designates an annular tank constituting the primary separating-tank, the same being suitably supported upon a bed 2 and containing water supplied thereto by the pipes 3. The upper portion of the tank is surrounded by a trough 4, having a discharge-spout 5. (Clearly shown in Fig. 2.) Disposed above the tank, with its periphery overlapping the inner walls thereof, is an upward-dished disk 5, which is rigidly mounted upon a shaft 6, driven from a pulley 7 through a belt, (not shown,) and inclosing the shaft 6 is a tubular shaft 8, carrying at its upper end a pulley 9 and at its lower end a hopper 10 and a fan 11, the latter being disposed over the disk and rotating in a direction opposite thereto. The fan 11 produces a current of air which is mainly directed horizontally outward, but of which a small portion is directed downward owing to the vertical divergence of the blast, so producing a slight downward pressure upon the upwardly-dished disk 5, the utility of which will be hereinafter explained. Disposed below the disk is a second fan 12, rigidly secured to a shaft 13, driven by a pulley 14, and inclosing the shaft 13 is a tubular shaft 15, carrying at its lower end a pulley 16 and at its upper end a pair of arms 17, which are bent to project downward into the tank and carry at their terminals scrapers or stirrers 18.

Disposed over the hopper 10 is a chute 19, down which the finely-powdered rock, sand, or earth containing the graphite or other materials is fed. Thence it passes into the hopper and down upon the disk 5, where the finer particles or flakes of graphite are retained by the slight downward pressure of the blast of air from the fan 11, while the coarser portions drop into the tank 1. The flakes caught by the disk 5 under centrifugal action due to the rotation of the disk are discharged outward and upon the surface of the water contained in the tank, this action being assisted by the blast of air from the fan 12, which impinges the discharge of finely-divided graphite as it escapes in a sheet from the periphery of the disk and operates to spread it out over the water and also to impel it laterally to the trough 4, whence it es-

capes through the spout 5 and is caught in a suitable receptacle. The coarser portions of the graphite, rock, and sand or dirt mixed therewith are forced out of the tank and down an outlet 20, the scrapers 18, as shown in Fig. 2, being preferably disposed tangentially to their path of movement, thus to prevent the material from banking up against the inner wall of the tank, as will be readily understood. Communicating with the outlet 20 is a casing 21, housing an ordinary conveyer 22, driven from a pulley 23, and this conveyer elevates the material and discharges into a hopper 24. (Shown in detail in Fig. 3.) Communicating with the hopper is a spout 25, tapped into the chute 19, the mouth of the spout being covered by a fine screen 26 to effect separation of the finer particles of graphite which mix with the materials elevated by the conveyer 22. In the hopper the material has oil, either coal-oil or any other suitable kind, sprayed upon it from a pipe 27, and the mixed graphite, sand, &c., escapes through a chute 28 into a washing-tank 29, containing a rotary agitator 30, driven by a belt 31 from the upper shaft 32 of the conveyer 22, the water of the tank 29 being kept at boiling heat by steam supplied through pipes 32^a. The lighter particles of graphite separated by the agitator and that float on the surface of the water in the washing-tank are removed by a skimming device 33 and are discharged into a tank 34, containing water, whence they are removed. The skimming device comprises a belt 34^a, supported by two pulleys 34^b, disposed in horizontal alinement above the tank 29, one of the pulleys being driven by any suitable means, not necessary to be shown. Secured at regular intervals to the belt are curved arms 34^c, which are in length equal to the width of the tank, which latter is rectangular in shape, the arms being hinged to keepers 34^d, secured to the belt, a spring 34^e, coacting with each arm, operating normally to cause it always to occupy a position at right angles to the belt, while permitting it to yield, as indicated by dotted lines. The tank has associated with the upper portion of its rear end an inclined plate 34^f, supported in the tank by a plate 34^g, the outer end of the plate 34^f being projected over the upper edge of the tank to constitute a lip 34^h. As the belt is rotated the arms or skimmer elements 34^c travel along the upper surface of the material contained in the tank and convey it to the plate 34^f, up which it is pushed, the incline of the said plate operating to cause the arm to be folded inward toward the belt, as shown; but as soon as it passes the lip 34^h the arm will resume its normal position.

The coarser portions of the graphite and any sand or the like remaining in the washing-tank pass down an outlet 35 into a conduit 36, in which is arranged a screw conveyer 37, which feeds the material to a second bucket conveyer 38, arranged in a housing 39, the conveyer being driven by a pulley 40, revolved by a belt, not necessary to be shown. The material elevated by the conveyer 38 is discharged into a hopper 41, thence passes through a chute 42 into the hopper 43 of a muller comprising two circular blocks of wood 44 and 45, the latter being stationary and the former being revolved by a shaft 46, driven by a pulley 47. The mulling-blocks are arranged within a tank 48, containing water and provided with a spout 49, which discharges into a trough 50, having a screen 51 to separate the sand, &c., from the graphite, the trough having connected with it a pipe or conduit 52, which connects with a settling-tank 53 of the usual construction. As the upper muller-block is rotated it operates to reduce the graphite to a pasty mass, which settles in the tank 53, whence it is removed, the tank being provided with the usual baffle-plates 54 common to such structures and with an overflow-spout 55.

The operation of this machine is extremely rapid and is continuous and effects in a thoroughly efficient and practical manner the separation of the graphite from any associated impurities.

Having thus described the invention, what I claim as new is—

1. An apparatus of the character specified, comprising a rotary receiving-table, and pneumatic means for holding the finer particles of graphite thereon while the coarser portions escape.

2. An apparatus of the character specified, comprising a rotary receiving-table, pneumatic means for holding the finer particles of graphite thereon while the coarser portions escape, and pneumatic means for impelling the finer particles laterally to a point of discharge.

3. An apparatus of the character specified, comprising an upward-dished receiving-table, a fan disposed above the table for holding the finer particles of graphite thereon while the coarser portions escape, and a fan disposed beneath the table for impelling the finer particles to a point of escape.

4. An apparatus of the character specified, comprising an annular tank, a rotary upward-dished receiving-table projecting over the tank, a fan disposed respectively above the table and rotating in the direction opposite that of the table, and rotary scrapers disposed within the tank.

5. An apparatus of the character specified, comprising means for separating the finer graphite from any associated impurities, means for conserving the finer particles, a washing-tank embodying agitating mechanism, means for conveying the residuum to the washing-tank, means for mixing oil with said residuum before being discharged into the washing-tank, a skimming device associated with the tank to remove the finer particles from the tank, a muller, means for convey-

ing the coarser particles from the washing-tank to the muller, and a settling-tank communicating with the muller.

6 An apparatus of the character specified, comprising an annular tank having a peripheral trough associated therewith, an upwardly-dished receiving-table having its periphery disposed over the tank, blast mechanism disposed above and below the table and rotating in a direction opposite thereto, a hopper associated with the upper blast mechanism, rotary stirrers disposed within the tank, a washing-tank, conveying mechanism communicating with the annular tank and discharging into the washing-tank, a chute for discharging the coarser portions of graphite to the hopper of the upper fan and the finer particles to the washing-tank, means for supplying oil to the mixed finer and coarser portions before entry into the washing-tank, agitating and skimming mechanism associated with the washing-tank, a muller, conveying mechanism communicating with the washing-tank and discharging into the muller, and a settling-tank in communication with the muller.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

ISRAEL F. GOOD.

Witnesses:
PETER G. CONRAD,
DAVID T. HISKEY.

No. 768,035. PATENTED AUG. 23, 1904

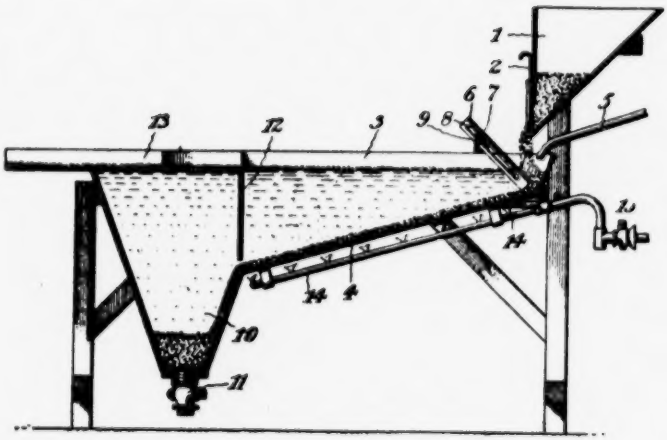
G. D. DELPRAT.

EXTRACTING ZINC OR OTHER SULFIDS FROM THEIR ORES.

APPLICATION FILED JAN. 2, 1903.

NO MODEL.

2122



Witnesses:
C. C. Cheney
R. H. Lawrence

Inventor:
Guillaume Jacques Delprat
by Cheney Brothers
Atty.

No. 768,035. Patented August 23, 1904.

UNITED STATES PATENT OFFICE.

2123

GUILLAUME D. DELPRAT, OF BROKEN HILL, NEW SOUTH WALES, AUSTRALIA.

EXTRACTING ZINC OR OTHER SULFIDS FROM THEIR ORES.

SPECIFICATION forming part of Letters Patent No. 768,035, dated August 23, 1904

Application filed January 2, 1903. Serial No. 137,585. (No specimens.)

To all whom it may concern:

Be it known that I, GUILLAUME DANIEL DELPRAT, a subject of the Queen of the Netherlands, residing at Broken Hill, in the State of New South Wales and Commonwealth of Australia, have invented certain new and useful Improvements in Extracting Zinc or other Sulfids from Their Ores, of which the following is a specification.

The finely-divided ores are immersed in a hot but preferably not boiling solution of salt cake or of sodium sulfate and sulfuric acid, and the sulfids rise to the top and are skimmed off or otherwise removed.

A suitable apparatus for carrying out the process is shown in section in the accompanying drawing.

Below an ordinary bin or feed-hopper 1, having a regulating discharge-door 2, is the pan or vessel 3, having a sloping bottom 4. The liquor or chemical solution is supplied by pipe 5 from a suitable reservoir (not shown) at an upper level. Just below the door 2 is a plate 6 on pintles or pivots 7 in slots 8, adapted to be clamped by set-screws 9 when the plate is adjusted to the required angle and with the required extent of opening between the lower edge of said plate 6 and the bottom 4, the directing-plate being primarily to insure the total immersion of all particles of ore in the fluid or liquor. At the lower end of the inclined bottom 4 is a tailings-receiver or sump 10, having a tailings-discharge 11. At the receiving end of the sump 10 is a baffle-plate 12, extending close to the face of said bottom 4, the object of which is to prevent accumulation of concentrates above the sump 10. Extending from the pan 3 is a launder or trough 13 to receive the overflow and the concentrates. Under the bottom 4 is piping 14, forming with the air-inlet cock 15 a Bunsen burner for gas, so that the solution or liquor may be raised to any desired temperature. The ore fed from the hopper 1 drops into the heated bath and slides by gravity over the bottom to the sump, the ore particles being raised by the gas-bubbles to the surface of the liquor during the travel of the ore over the inclined bottom and are floated off with the overflow through the trough 13 or, if desired, skimmed off. This apparatus forms the subject-matter of a separate application for patent filed March 9, 1903, Serial No. 146,895, to which I therefore make no claim in this application.

In practice the "sulfid ores," including in such term the products and waste from other metallurgical processes, are finely pulverized, as well understood, and are then ready for immersion in the hot bath. This bath consists of a solution of salt cake in water of a specific gravity approximating to 1.4, (one and four-tenths,) which is kept hot, but preferably is not allowed to boil. As an alternative the bath consists of a solution of sodium sulfate in water, to which is added free sulfuric acid, so that the resultant will approximate the stated specific gravity of 1.4, (one and four-tenths,) and this bath is also kept heated and likewise preferably not allowed to boil. As the ore immerses itself in the heated bath the sulfids with gas-bubbles of sulfureted hydrogen attached disengage themselves from the gangue, rising to the top, whence they may flow away or be skimmed off. The tailings or waste may be removed from the bottom of the sump at intervals as desired.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. The method of separating ores from their gangue, which consists in forming an aqueous solution of an acid capable of reacting with the ore to form a gas and increasing the density of said solution by adding thereto a suitable substance, then feeding the mixture of ore and gangue to the solution, decreasing the density of the gas as it is formed on the ore particles, and removing the ore particles raised to the surface, substantially as described.

2. The method of separating ores from their gangue, which consists in forming a solution of a suitable acid capable of reacting with the ore to form a gas, increasing the density of the solution by adding thereto a suitable salt soluble therein, then feeding the mixture of ore and gangue to the solution and decreasing the density of the gas as it is formed, whereby

the size of gas-bubbles will be increased and the ore raised to the surface of the solution, substantially as described.

3. The method of separating ores from their gangue, which consists in forming a solution of an acid capable of reacting on the ore to form a gas, and increasing the density of said solution by a suitable substance, then feeding the finely-ground mixture of ore and gangue to the solution and finally removing the ore particles raised to the surface, substantially as described.

4. The method of separating sulfid ores from their gangue, which consists in forming a solution containing sulfuric acid, and adding thereto a substance soluble therein and capable of increasing the density of the solution, feeding fine ore thereto capable of reacting with sulfuric acid to generate a gas and thereby raise the ore to the surface, and removing the ore so raised to the surface, substantially as described.

5. The method of separating sulfid ores from their gangue, which consists in forming a solution of sulfuric acid and a sulfate, maintaining the solution heated below the boiling-point, feeding finely-ground ore thereto, whereby the acid will react with the soluble sulfid-ore particles present to form sulfureted hydrogen and be lifted by bubbles of said gas to the surface of the solution, and removing the ore so carried to the surface of the solution, substantially as described.

6. The method of separating sulfid ores from their gangue, which consists in forming a solution of sulfuric acid and sodium sulfate, maintaining the solution heated below the boiling-point, feeding finely-ground ore thereto, whereby the acid will react with the soluble sulfid-ore particles present to form sulfureted hydrogen and be lifted by bubbles of said gas to the surface of the solution, and removing the ore so carried to the surface of the solution, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GUILLAUME D. DELPRAT.

Witnesses:
FRED WALSH,
PERCY NEWELL.

No. 771,075 PATENTED SEPT 27, 1904

C. KENDALL.

SEPARATION OF MINERAL SUBSTANCES BY MEANS OF THE SELECTIVE ACTION OF OIL.

NO MODEL. APPLICATION FILED JULY 31, 1903. 2 SHEETS-SHEET 1.

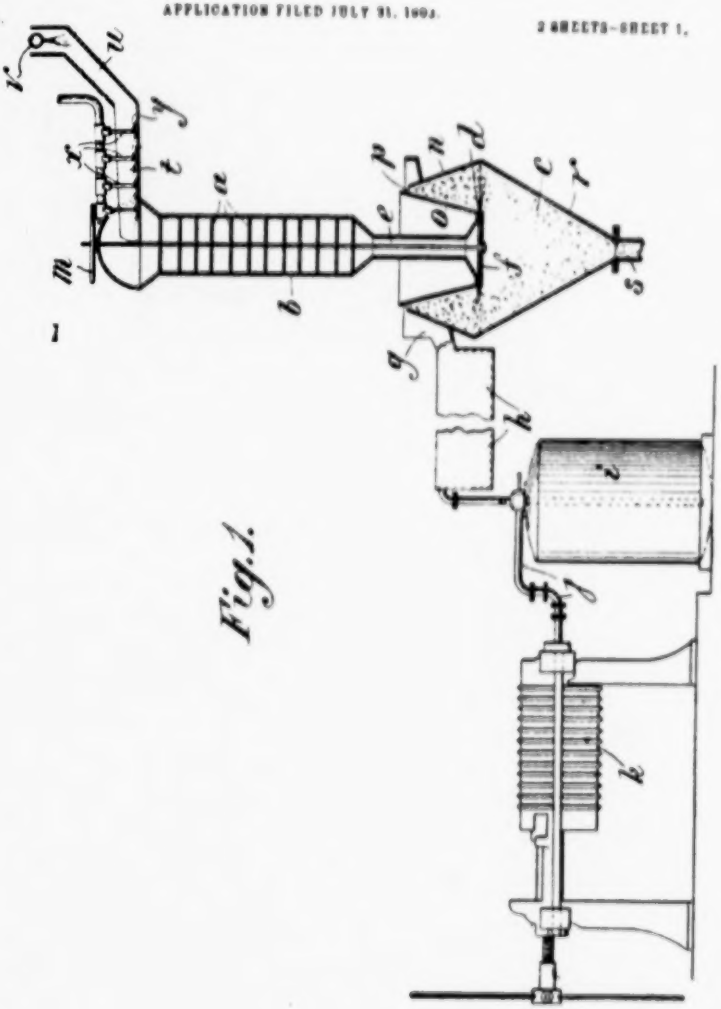


Fig. 1.

Witnesses
Chas. P. Wright Jr.
Alice M. E. Lumley

Inventor
Cosmo Kendall
By A. S. Patterson,
Atty

No. 771,075 PATENTED SEPT. 27, 1904

C. KENDALL.

SEPARATION OF MINERAL SUBSTANCES BY MEANS OF THE SELECTIVE ACTION OF OIL.

APPLICATION FILED JULY 21, 1903.

NO MODEL. 2 SHEETS—SHEET 2.

2127

Fig. 2

Fig. 3

Fig. 4.

Fig. 5

Fig. 6.

Fig. 7

Fig. 8.

Fig. 9.

Fig. 10.

Fig 11

Fig. 12.

Fig. 13.

Witnesses
Chas. F. Wright
Thos. W. Ebenburg

Inventor
Cosmo Kendall
By A. S. Pattison
Atty.

No. 771,075. Patented September 27, 1904.

UNITED STATES PATENT OFFICE.

COSMO KENDALL, OF UPPER NORWOOD, ENGLAND.

SEPARATION OF MINERAL SUBSTANCES BY MEANS OF THE SELECTIVE ACTION OF OIL.

SPECIFICATION forming part of Letters Patent No. 771,075, dated September 27, 1904.

Application filed July 21, 1903. Serial No. 166,484. (No specimens.)

To all whom it may concern:

Be it known that I, COSMO KENDALL, a subject of the King of Great Britain and Ireland, residing at Upper Norwood, in the county of Surrey, England, have invented Improvements in the Separation of Mineral Substances by Means of the Selective Action of Oil, of which the following is a specification.

According to this invention crushed graphite-containing material—for example, graphite ore or graphite waste—is mixed with water and brought intimately into contact or thoroughly mixed with pure thin oil—as, for example, kerosene or paraffin oil—which adheres to and by reason of its levity separates the graphitic substance (this may be more or less pure graphite) from associated rocky matter, which by reason of its weight and non-affinity to oil sinks in and is conveniently carried off by the water. The graphitic substance is or may be afterward separated from the oil and the latter is or may be used again in subsequent similar operations. In separating graphitic substances in this way I do so or may do so by means of apparatus and in the manner that I will now describe. The crushed graphite-containing material mixed with water and oil is supplied to an agitator or mixer adapted to produce a thorough mixing of the materials under the action of gravity alone, and from this agitator or mixer the mixture passes in the form of a thin sheet or thin sheets or the like (preferably annularly and horizontally) and at a considerable velocity into a vessel, which is initially filled with water or water and oil and is of such a shape and has the material discharged into it in such a position as to enable water and rocky matter or gangue to pass off at an outlet or outlets at or near the bottom and the oil to carry the graphitic substance up with it to the surface, whence the mixture flows off to have the graphitic substance separated from foreign matter, including it may be the oil, in any suitable manner.

In one example of the treatment of graphite-containing material according to this invention the apparatus is employed that is shown diagrammatically in the accompanying drawings, whereof—

Figure 1 is a diagrammatical general sectional elevation of the apparatus, and Figs. 2 to 13, inclusive, are plans of twelve disks used therein.

The crushed material mixed with water and oil is supplied to an agitator or mixer comprising a number of disks or other plates *a*, perforated or made foraminous and horizontally disposed, spaced apart, and fixed within a vertical casing *b*. Below the agitator or mixer there is a vat *c*, containing water, into which the mixture is projected in a thin horizontal annular sheet *d* from a vertical pipe *e*, the lower end of which is, say, twenty-four inches *b*elow the top of the vat and is provided with a valve-like device *f*, by means of which at the bottom of the pipe *e* an annular outlet of, say, twenty-four inches in diameter is formed and which can be adjusted in depth by means of a hand-wheel *m* to vary the cross-sectional area of the outlet. The oil and the graphitic substance carried by it rise to the surface of the water in the vat and flow over the rim of the vat into an inclined launder *g*, from which they flow into a settling-tank *h*, (or series of settling-tanks or into a vessel similar to that above described.) From the settling tank or tanks the surface matter flows into a closed receptacle *i*, whence it can be forced by means of compressed air through a pipe *j* into a filter-press *k*. The plates *a* of the agitator or mixer have their perforations so arranged and shaped that different portions of the materials will be caused to flow at different rates within the agitator or mixer, and will consequently become thoroughly mixed.

Figs. 2 to 13, inclusive, are plans of the twelve disks employed in the apparatus shown and show relative sizes and an arrangement of the perforations *l* thereof by means of which the effect desired can be attained. The total area of the perforations *l* in each disk *a* is equal to the cross-sectional area of the narrowest portion of the pipe plus an amount necessary to compensate for friction. The vat *c* is so shaped that inclined surfaces *n* and *o* deflect

the ascending oily matter into a constricted annulus *p* of, say, a diameter of forty-eight inches and a width of an inch and a half, and another inclined surface *r* deflects the falling water and rocky matter or gangue toward an outlet *s*, which is centrally arranged and is, say, forty-eight inches below the bottom of the pipe *r*. The oil may be mingled with the material to be treated as it is borne to the top of the agitator or mixer through a channel *t* by a sufficiency of water supplied to it in a conduit *u*, as through perforations in a pipe *v*, the oil passing into the mixture through a number of fine orifices arranged to discharge beneath the moving mass of material. The oil may thus be supplied by a number of pipes *x*, which are at right angles to the direction of flow of the material and have perforations to discharge the oil in the same direction as that of the material and each of which has behind it an inclined plane *y*, adapted to direct the material to be treated slightly upward and over the perforations of the corresponding oil-pipe *x*. The rocky matter or gangue issuing from the vat may be passed to another and similar agitator or mixer for like treatment if necessary. The remaining oil in the cakes of the filter-press may be partly or wholly displaced by a subsequent water wash, and thereby partly or wholly recovered

It will be understood that the dimensions hereinbefore stated may be varied in accordance with the quantity of material to be treated in a given time, and they are given only by way of example, having been found suitable in practice.

What I claim is—

1. The hereinbefore-described process for the treatment of finely-divided material for the separation of graphitic substance contained therein from associated rocky matter or gangue, consisting in mixing said material with water, bringing said material intimately into contact or thoroughly mixing it with suitable pure thin oil, as kerosene or paraffin oil, projecting at a considerable velocity the mixture so produced under the surface of a volume composed of said material, water, and oil, allowing oil and graphitic substance adhering thereto to pass upward to said surface, and drawing off from said surface oil and graphitic substance immediately on arrival at said surface.

2. The hereinbefore-described process for the treatment of finely-divided material for the separation of graphitic substance contained therein from associated rocky matter or gangue, consisting in mixing said material with water, bringing said material intimately into contact or thoroughly mixing it with suitable pure thin oil, as kerosene or paraffin oil, projecting horizontally or substantially horizontally the mixture so produced under the surface of a volume composed of said material, water, and oil, allowing oil and graphitic substance adhering thereto to pass upward to said surface, and drawing off from said surface oil and graphitic substance immediately on arrival at said surface.

3. The hereinbefore-described process for the treatment of finely-divided material for the separation of graphitic substance contained therein from associated rocky matter or gangue, consisting in mixing said material with water, bringing said material intimately into contact or thoroughly mixing it with suitable pure thin oil, as kerosene or paraffin oil, projecting at a considerable velocity the mixture so produced under the surface of a volume composed of said material, water, and oil, allowing oil and graphitic substance adhering thereto to pass upward to said surface, drawing off from said surface oil and graphitic substance immediately on arrival at said surface, and forcing matter so drawn off into a filter-press so as to recover oil.

4. The hereinbefore-described process for the treatment of finely-divided material for the separation of graphitic substance contained therein from associated rocky matter or gangue, consisting in mixing said material with water, bringing said material intimately into contact or thoroughly mixing it with suitable pure thin oil, as kerosene or paraffin oil, projecting horizontally or substantially horizontally the mixture so produced under the surface of a volume composed of said material, water, and oil, allowing oil and graphitic substance adhering thereto to pass upward to said surface, drawing off from said surface oil and graphitic substance immediately on arrival at said surface, and forcing matter so drawn off into a filter-press so as to recover oil.

5. The hereinbefore-described process for the treatment of finely-divided material for the separation of graphitic substance contained therein from associated rocky matter or gangue, consisting in mixing said material with water, bringing said material intimately into contact or thoroughly mixing it with suitable pure thin oil as kerosene or paraffin oil, projecting in the form of a thin sheet and at a considerable velocity the mixture so produced under the surface of a volume composed of said material, water, and oil, allowing oil and graphitic substance adhering thereto to pass upward to said surface, and drawing off from said surface oil and graphitic substance immediately on arrival at said surface.

6. The hereinbefore-described process for the treatment of finely-divided material for the separation of graphitic substance contained therein from associated rocky matter or gangue, consisting in mixing said material with water, bringing said material intimately into contact or thoroughly mixing it with suitable

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pure thin oil, as kerosene or paraffin oil, projecting horizontally or substantially horizontally in the form of a thin sheet and at a considerable velocity the mixture so produced under the surface of a volume composed of said material, water, and oil, allowing oil and graphitic substance adhering thereto to pass upward to said surface, and drawing off from said surface oil and graphitic substance immediately on arrival at said surface.

Signed at London, England, this 10th day of July, 1903.

COSMO KENDALL.

Witnesses:
H. D. JAMESON
A. NUTTING.

No. 776,145. PATENTED NOV. 29, 1904.

C. V. POTTER.

PROCESS OF SEPARATING METALS FROM SULFID ORES.

APPLICATION FILED JAN. 14, 1902.

NO MODEL.

2132

Fig. 1

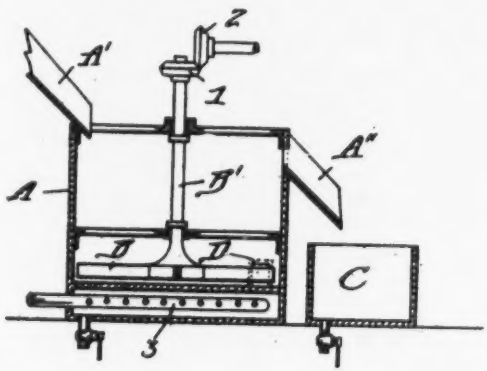
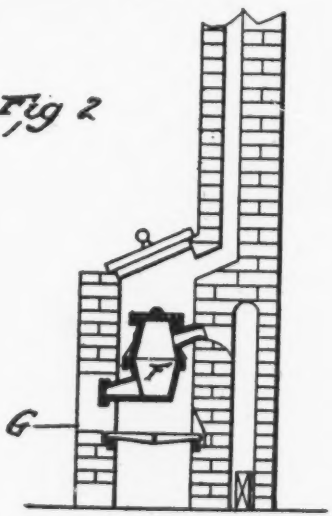


Fig 2



Witnesses:
C. S. Middleton
S. B. Middleton

Inventor
Charles V. Potter
by Richardson
Atty's

No. 776,145. Patented November 29, 1904.

UNITED STATES PATENT OFFICE.

2133

CHARLES VINCENT POTTER, OF BALACLAVA, VICTORIA, AUSTRALIA.

PROCESS OF SEPARATING METALS FROM SULFID ORES.

SPECIFICATION forming part of Letters Patent No. 776,145, dated November 29, 1904.

Application filed January 14, 1902. Serial No. 89,772. (No specimens.)

To all whom it may concern:

Be it known that I, CHARLES VINCENT POTTER, engineer, a British subject, and a resident of 43 The Avenue, Balaclava, in the State of Victoria, Commonwealth of Australia, have invented an Improved Process of Separating Metals from Sulfid Ores, of which the following is a specification.

The object of my invention is to separate metals from sulfid ores by an expeditious, effective, and inexpensive means and method.

The crude ore, concentrates, tailings, or slimes after being pulverized are placed in a suitable vat or vessel and a solution is then added, such solution consisting of water with the addition of from one per cent. to ten per cent. of any acid, (preferably sulfuric acid, for reasons hereinafter stated,) the acidulated strength of the solution being determined by the quality or nature of the sulfid ore to be treated. The small quantity of acid added does not act as a solvent.

Ores containing lead, zinc, copper, iron, gold, and silver in combination with sulfur I treat as follows: The ore in a state of fine division is placed in a vat or such like vessel provided with an internal stirrer or stirrers. The acidulated solution is then added thereto, such solution containing in the first instance, say, one per cent. only of the acid when mixing it with the ores, and after heat is applied thereto, as hereinafter directed, gradually increasing its acidulated strength until the determinate strength is reached, which in most instances will amount to two and a half per cent. of acid, or thereabout, to be decided on or governed by the apparent action of the solution on the material under treatment. Heat being applied, the effect of the acidulated solution becomes apparent by the bubbling up and gathering on the surface of the fluid of the metallic concentrates in the form of a pasty mass. Should this pasty substance be scanty, thin, and not swell and accumulate rapidly, so as to overflow the vat if not skimmed off, more acid must be added until the maximum separative activity is reached, which very slight experience and observation in applying this treatment to sulfid ores will enable the operator to determine. I use sulfuric acid preferably by reason of its cheapness and its capability of production from a by-product resulting from the process or treatment herein described. While the exact acidulated strength of such solution will depend on the metallic contents and general condition of the ore, ascertainable only by observation when under treatment as aforesaid, any variation of the acidulated strength found necessary or expedient will remain well within the limit before stated—namely, of from one to ten per cent. of the whole solution. The bulk solution to be added or applied to the class of ores lastly named would be, say, approximately two hundred and fifty gallons to every ton weight of ore, varying to some small extent, according to the absorbent quality of the ore and its degree of fineness. The stirrers are then freely used, and heat is applied to the vat or vessel directly or by means of steam injection therein at or near the floor of the vat or vessel. As the temperature of the solution and other contents of the vat or vessel rises it causes the metals to rise upward from the bottom of the vat and float upon the surface, from which it may be allowed to flow automatically and continuously into a separate receptacle or be skimmed off, as arranged, into a separate vessel for further treatment. The gangue accumulating in the bottom of the separating-vat, containing a small proportion of gold and silver, as well as all the rhodonite, garnets, silica, and the like, can be then further treated by cyanid or other of the well-known means or processes and the gold and silver be thus extracted therefrom. The said solution may be used over and over again by the addition from time to time of a small quantity of acid when it is apparent by the effect of the solution when reapplied to the material and heated that its acidulated strength has become diminished. The skimmings or concentrates, containing all the metals free from gangue, are then mixed with a certain quantity of crushed or coarsely broken-up iron or iron oxid, (the quantity of such iron required depending upon the quantity of sulfur the metals

contain,) also a quantity of powdered charcoal. This mixture is then placed in a suitable vessel or retort and a rapidly-produced heat applied, converting the mixture into a molten condition. After a short period it will be found that the sulfid of lead and silver has been reduced to metallic lead and silver. The retort can then be tapped at the bottom and these metals run off. In this step the iron changes places with the lead of the galena, the equation being $Pbs+Fe=Fe.S+Pb$. It will thus take fifty-six pounds of cast-iron to reduce two hundred and thirty-nine pounds of galena to two hundred and seven pounds of metallic lead. While this reduction is taking place the iron, having changed places with the lead, becomes sulfid of iron, and the zinc by the action of the great heat is vaporized and passed off in the form of vapor into a suitable vessel, wherein it becomes condensed into metallic zinc. The iron sulfid remaining in the retort is recrushed and roasted, the sulfur resulting from which may be utilized for the manufacture of sulfuric acid.

The means or process for treating ores, chiefly for the recovery of the gold therein, in combination with sulfur, such as iron pyrites or arsenical pyrites, is as follows: The ore is ground to a very fine powder, (the finer the better,) placed in a vat or suitable vessel, the said solution added, well stirred, and the heat applied in exactly the same manner as before described in relation to the lead and silver ores, thus separating the gold and other metals from the gangue in manner as before described. The skimmings or concentrates, which are now in a very small bulk containing practically all the gold, are then roasted in a suitable furnace, after which they will be in a condition to be treated by chlorin or cyanid in the well-known manner. By this treatment the difficulties of treating a large bulk of ores mixed with slimes and the necessity for dealing with the slimes by filtration are obviated and dispensed with and a better and more complete result obtained.

The accompanying drawings show, for example, a series of receptacles for carrying out the above-described process, in which—

Figure 1 is a sectional elevation of a vat and the tank, and Fig. 2 is a like view of the retort with its furnace.

In the drawings, A is the vat, having the chute A′ leading thereto, and B indicates the stirrer-arms, secured to a shaft B′, the stirrer-arms being rotated by means of the gearing 1 2 from a suitable source of power. The vat is shown as being heated by a gas-pipe 3, placed below the bottom of the vat. D is a door in the vat.

C indicates the separate tank, and A″ the chute for allowing the skimmings to flow from vat A to said tank C.

Fig. 2 shows the retort F placed in the furnace G, so as to be heated thereby.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The herein-described process of separating metals from pulverized sulfid ores which consists in adding to the same an acid solution which is a non-solvent of the precious metals, then applying heat to the same, and removing the sulfids from the surface of the solution, substantially as described.

2. The process of separating metals from pulverized sulfid ores, concentrates, and slimes by mixing an acidulated solution therewith which is a non-solvent of the metal to be separated, stirring, heating, skimming or floating off such metals from the surface of the whole admixture as they are carried to the surface so as to recover such concentrates of metals ready for after treatment, as, and in manner hereinbefore described

3. The method of separating sulfid ores from their gangue, which consists in forming a suitable solution containing sulfuric acid to react on the soluble sulfids present to form bubbles of sulfureted hydrogen on the ore particles and thereby raise them to the surface, and removing the ore particles so raised, substantially as described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

CHARLES VINCENT POTTER.

Witnesses:
ALFRED FORD,
JONATHAN BEAR.

No. 777,273. PATENTED DEC 13, 1904.

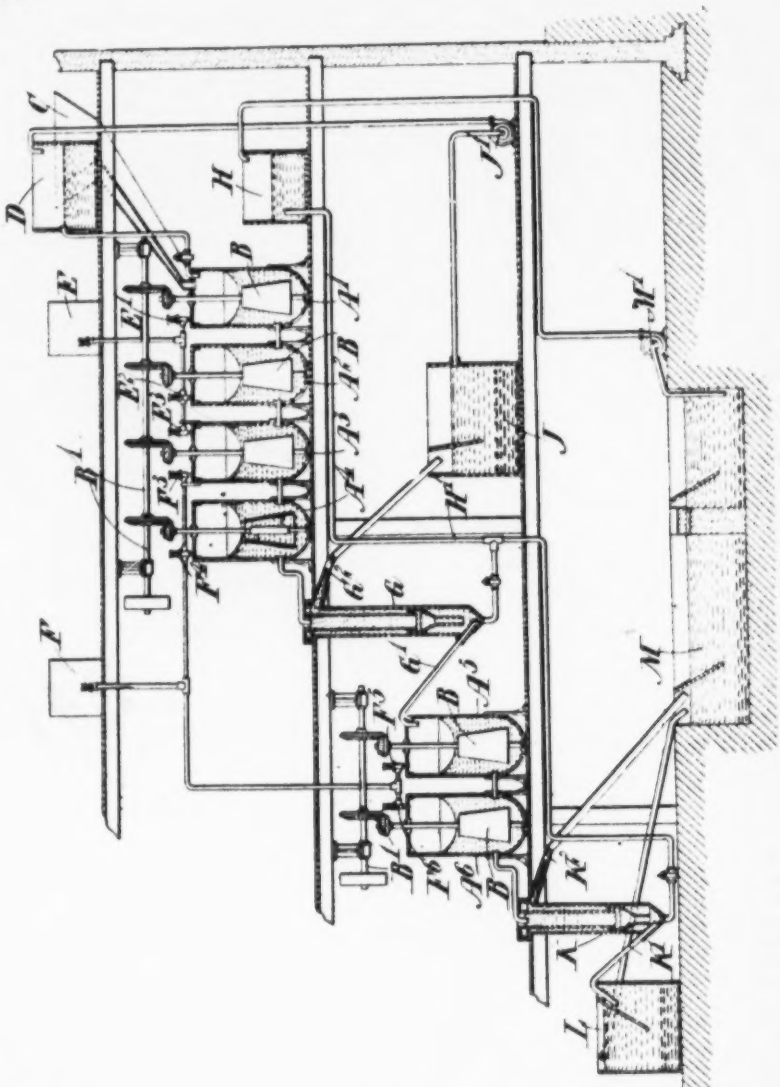
A. L. CATTERMOLE

SEPARATION OF THE METALLIC CONSTITUENTS OF ORES FROM GANGUE.

APPLICATION FILED SEPT 28, 1903

NO MODEL.

2136



Witnesses.
Harold Shrod
Mabel Hayes

Inventor
Arthur L. Cattermole
By Knight Bros.
Attorneys

No. 777,273. Patented December 13, 1904.

UNITED STATES PATENT OFFICE.

ARTHUR EDWARD CATTERMOLE, OF LONDON, ENGLAND.

SEPARATION OF THE METALLIC CONSTITUENTS OF ORES FROM GANGUE.

SPECIFICATION forming part of Letters Patent No. 777,273, dated December 13, 1904.

Application filed September 26, 1903. Serial No. 174,947. (No specimens.)

To all whom it may concern.

Be it known that I, ARTHUR EDWARD CATTERMOLE, a subject of the King of England, residing at Highgate, London, England, have invented certain new and useful Improvements in the Separation of the Metallic Constituents of Ores from Gangue, of which the following is a specification.

The present invention relates to improvements in the separation of the metalliferous constituents of ores and the like from gangue by means of the selective action of oils and certain tar products or similar compounds (all hereinafter referred to as "oil") on metallic or metalliferous matter.

The invention depends upon the application of the following facts: First, when a mixture of powered metalliferous matter and gangue is treated with oil suspended in water—that is to say, in emulsion—the oil has a more or less selective action and will coat the particles of metalliferous matter in preference to the particles of gangue, while the particles of gangue will be wetted by the water; second, if the water which is mixed with the oil is acidulated with mineral, fatty, or other acid the selective action of the oil will thereby be rendered more marked and decisive; third, if the proportion of oil is kept within reasonably low limits (differing in different cases, according to the nature of the mineral to be treated and the consistency and nature of the oil) and if the mixture of water, oil, metalliferous particles, and gangue be thoroughly agitated the metalliferous particles which have become coated with oil will adhere together and form granules, which granules, partly by reason of gravity or partly on account of their bulk, as compared with the individual grains of gangue, will offer ready means for separation in an up-current separator, a jig, or other similar appliance. This action is facilitated if the oil before addition to the liquor is brought into the condition of an emulsion in water containing a small percentage of soap or other emulsifying agent. These facts are utilized for the purpose of separating the metalliferous constituents from the gangue of the ore in the following manner: In a suitable apparatus, an example of which will be hereinafter described, the ground or pulped ore is caused to be violently agitated, as by a revolving stirrer, in a mixture of water and oil, the liquor being acid. As the agitation proceeds the particles of metalliferous matter agglomerate together and may be observed in the form of granules, the size of which will depend, among other things, upon the percentage of oil used. This granulation of the metalliferous constituents of the ore affords the means by which at a later stage of the process it is possible to separate the metalliferous material from the gangue, as will be hereinafter particularly described. In practice a continuous process is used—that is to say, water, ground ore, or pulp and oil, preferably emulsified, are continuously fed into a series of vessels, and the products of the agitation are continuously fed into an up-current separator or jig or similar device, which in the case of the up-current separator separates the metalliferous granules from the gangue by allowing them to fall to the bottom of the vessel and to be carried away by a downward stream, while the particles of gangue are carried away by an upward steam.

The accompanying drawing is a diagram illustrating in sectional view one means of carrying out the process according to this invention, in which the liquid mass is brought into an acid condition.

A series of connected mixing vessels $A' A^2 A^3 A^4 A^5$ are provided with stirrers B, rotated from driving-shafts B'. Crushed ore from a hopper C and water from a tank D are introduced into the first vessel, A', and oil or emulsion is fed from a tank E, through pipes $E' E^2 E^3$, to the various vessels. The mixture is vigorously agitated to break up and emulsify the oil and to bring about intimate contact of the divided oil with the metalliferous mineral particles and of the oiled particles with each other. It is found under these conditions the metalliferous mineral particles abstract the oil and become coated with a thin oily film, which is insufficient to materially lessen their specific gravity, and that under agitation such slightly-oiled particles adhere, nucleate, and agglomerate into small more or less rounded masses or granules disseminated

throughout the mass of gangue, which remains free and practically devoid of oil. In order to maintain the liquid mass in which the separation is effected in an acid condition, a small proportion of the sulfuric or other acid is introduced into one or more of the vessels from a tank F, having discharge-pipes F^2 F^3 F^4. After agitation to a certain extent (in four vessels, as illustrated, for example) the mixture is passed into an up-current classifier G, which is supplied with a stream of acidulated water from a tank H through a pipe H'. As the granules remain specifically heavier than the gangue or can by suitably adjusting the amount or oil and the agitation be obtained of a size larger than that of the gangue particles, the granules, with a certain amount of heavy sands, sink to the bottom and are discharged through a pipe G' into the vessel A^4, while the lighter sands are carried away by the upward current and discharged through outlet G^2 to a light-sands tank J, from which the water may be returned by a pump J' to the feed-tank D for reuse. In order to separate the granules from the heavy sands, the mixture is subjected to further agitation in the vessels A^4 A^5 and is then passed into a second classifier K, from which the granules are removed at the bottom by the pipe K' into the metalliferous-mineral tank L, while the heavy sands are discharged from the upper pipe K^2 into a heavy-sands tank M. The water from the tanks L and M is returned by a pump N' to the feed-water tank H. This apparatus is illustrated only as one convenient method of carrying out this invention, and it is to be understood that its nature and arrangement can be considerably varied. Thus the acid condition may be obtained by acidulating the ore-pulp before agitation with the oil or oil emulsion, or the ore-pulp may be first agitated with emulsion to slightly agglomerate the ore, which may be settled and washed and the product then treated by agitation with acid solution to granulate the mineral and free the gangue. Which of the methods is most applicable depends upon the nature of the mineral matter and of the gangue, their state of division, and relative proportions. The agitation vessels may be separate, with arrangements for charging and discharging, the charging with pulp and the addition of acid and of oil or emulsified oil and the agitation and discharge successively in the series of vessels being so timed that the output of treated ore is kept continuous and constant. The classifiers used may be jigs, shaking-tables or the like, or sizing apparatus, whereby the comparatively larger mineral granules may be separated from the finer gangue and one or more classifiers may be employed.

The proportion of oil used depends upon its viscosity, the fineness of the ore and other factors, and the consistency and size of the mineral granules desired. The more oil used the larger, softer, and less numerous the granules. With, say, ten per cent. of oil to the weight of metalliferous mineral a few pasty masses of oil-agglomerated metalliferous mineral matter will generally result. Oil in excess of this may cause all the granules to coalesce into one soft mass. Usually an amount of oil varying from four per cent. to six per cent. of the weight of metalliferous mineral matter present in the ore yields granules of suitable size, consistency, and specific gravity for ready separation from the gangue in the up-current or other apparatus used for classification.

The amount of emulsifying agent if used to form the oil emulsion depends upon the viscosity and nature of the oil. When soap is employed, an amount varying from three per cent. to five per cent. of the weight of oil usually suffices, this being dissolved in, say, ten times its weight of water. For emulsification a low alkalinity of the emulsifying agent is generally best.

The "oil" used may be animal, vegetable, or mineral oil or mixtures of these or such coal or wood tar products or other substances which exercise, like oils, a preferential physical affinity for metallic mineral matter as distinguished from gangue. The emulsifying agent (if such is used) may be any substance capable of holding the oil in a fine state of division in suspension in water without acting on the mineral matter or preventing the action of the oil—for example, soap, alkaline cresylates, or other substances, solutions of which in water froth on agitation. The emulsifying agent, or the constituents liberated therefrom under the action of acid, appears to have a decided effect in aiding the granulation, as described. In some cases, as with wood-tar and some coal-tar products, these when agitated in weak alkaline solutions provide their own emulsifying agents, soluble resinates, cresylates, &c., being thereby formed which emulsify the bulk of the tar or product. In this process the amount of emulsifying agent employed is kept as low as possible compatible with the proper subdivision of the oil to prevent undue waste of the alkaline or basic constituent present, which is necessarily destroyed in the acid solution used. When soap is used, the fatty acid becomes associated with the mineral granules and can be subsequently recovered. Emulsification in some cases, as with the heavier residuum oils or tars, may be assisted by first mixing therewith a small amount of fatty oil or fatty acid. Preferably one emulsifying agent is employed throughout the process.

In order to recover the oil from the granules after their separation from the gangue, they may be agitated with the emulsifying agent in a stronger or more active condition or proportion than was used in the emulsification of the oils initially, and the action of this

emulsifying agent in stripping the oil from the metalliferous mineral particles may be aided by attrition. The strengthening of the emulsifying agent may be effected by increasing the proportion of the agent or of the alkaline base in solution, or both, the percentage strength of the solution needed depending upon the oil used and the nature of the metalliferous mineral matter with which it is associated. Usually if oleic soap is employed and caustic potash amounts varying from one-quarter of one per cent. to three per cent. or four per cent. of one or the other in solution suffice, the less readily emulsified oils, as the residuum oils, requiring the larger amounts. The removed oil is obtained as a dilute emulsion, which on standing some time separates. The cream or concentrated emulsion may then be used for making fresh emulsion for treating fresh ore. To hasten this separation of "cream," mechanical devices may be employed.

Generally with wet crushed ore removal of the bulk of the water for reuse in the mill is necessary. In such case the pulp is settled and the wet ore only fed into the agitators, acid-water being added to thin them. The circuit of such liquids can thus be kept distinct from that of the mill-water, suitable arrangements being made for settling the mineral-depleted sands and slime and for addition of acid and fresh water, as required from time to time.

In certain cases, as where but little mineral is present in the ore, to increase the nucleating or granulating factor pulverized mineral matter obtained in a previous operation or other matter having an affinity for oil from a different source may be introduced into the ore, or a portion of already granulated and separated mineral matter may be returned to maintain the necessary amount of mineral in the ore under treatment.

In carrying out the process the ore may be roughly sized into two or more parts, which are then treated separately. With certain ores it may be preferable to use in some stages of the process a rolling form of agitation, as in cylinders or barrels, to obtain good granulation of the mineral.

It has been found that if the water in which the operation is conducted contains a percentage of acid, varying in the case of sulfuric acid of 1.84 specific gravity from one-half of one per cent. to a tenth of one per cent., the operation is greatly facilitated. Indeed, if there is no acid present there is a great tendency for the oil to coat the gangue or some portion of the gangue, as well as the metalliferous particles. It is preferable to use water acidulated with about one-fifth of one per cent. of this acid, and it is found in practice that such a degree of acidulation is sufficient completely to prevent the gangue from being oiled, while it is not, generally speaking, enough to cause the water to act chemically upon the metalliferous matter.

I am aware that the selective action of oils and the like on metallic matter has been made the basis of previous processes for separating the metalliferous constituents of ores from gangue. For example, oil has been used to float off metalliferous mineral from ore-pulp, and its use has also been proposed to form a pasty mass of crushed ore from which the gangue could afterward be washed out by means of water, and I do not claim the employment of oil in any such manner.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The herein-described process of separating metalliferous matter from gangue which consists in mixing the pulp with an amount of oil equaling only a fraction of the metalliferous constituents, agitating the mass until the oil-coated metalliferous matter is agglomerated into granules and subjecting the mixture to classification to remove the small non-coated particles from the granules.

2. The herein-described process of separating metalliferous matter from gangue which consists in mixing the ore with an emulsion containing an amount of oil equaling only a fraction of the metalliferous constituents agitating the mass until the oil-coated metalliferous matter is agglomerated into granules and subjecting the mixture to classification to remove the small non-coated particles from the granules.

3. The herein-described process of separating metalliferous matter from gangue which consists in mixing the ore with an emulsion containing an amount of oil equaling only a fraction of the metalliferous constituents and an acid, agitating the mass until the oil-coated metalliferous matter is agglomerated into granules and subjecting the mixture to classification to remove the small non-coated particles from the granules.

4. The herein-described process of separating metalliferous matter from gangue which consists in mixing the ore with an emulsion containing an amount of oil equaling only a fraction of the metalliferous constituents and an acid, agitating the mass until the oil-coated metalliferous matter is agglomerated into granules and subjecting the mixture to upcurrent classification to remove the small non-coated particles from the granules.

5. The herein-described process of separating metalliferous matter from gangue which consists in mixing the ore with an emulsion containing an amount of oil equaling only a fraction of the metalliferous constituents and an acid, agitating the mass until the oil-coated metalliferous matter is agglomerated into granules and separating out the light sands, thereafter further agitating the mass to increase the size of the granules and separating out the heavy sands from the granules.

6. The herein-described process of separating metalliferous matter from gangue which consists in agitating a mixture of powdered ore, oil emulsion and water containing an acid and adding particles of material having an affinity for oil to assist in the formation of granules of oil-coated particles and subjecting the mixture to a classification to remove the small non-coated particles from the granules.

7. The herein-described process of separating metalliferous matter from gangue which consists in agitating a mixture of powdered ore, oil emulsion and water containing an acid and adding particles of material having an affinity for oil to assist in the formation of granules of oil-coated particles and subjecting the mixture to classification to remove the small non-coated particles from the granules.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses

ARTHUR EDWARD CATTERMOLE.

Witnesses:
HAROLD WADE,
HARRY B. BRIDGE.

No. 777,274. Patented December 13, 1904.

UNITED STATES PATENT OFFICE.

ARTHUR EDWARD CATTERMOLE, HENRY LIVINGSTONE SULMAN, AND HUGH FITZALIS KIRKPATRICK-PICARD, OF LONDON, ENGLAND.

CONCENTRATION OF MINERALS FROM ORES.

SPECIFICATION forming part of Letters Patent No. 777,274, dated December 13, 1904.

Application filed March 29, 1904. Serial No. 200,830. (No specimens.)

To all whom it may concern:

Be it known that we, ARTHUR EDWARD CATTERMOLE, HENRY LIVINGSTONE SULMAN, and HUGH FITZALIS KIRKPATRICK-PICARD, subjects of the King of England, residing at London, England, have invented certain new and useful Improvements in the Concentration of Minerals from Ores, of which the following is a specification.

Our process has for its object the separation of minerals from the silicious or earthy matters of ores by means of soaps or similar compounds, and is dependent upon the superior physical attraction exhibited by minerals for fatty or resin acids or for certain other aromatic derivatives (such as cresols, phenols, &c.) which form soluble salts or compounds with alkaline hydrates as compared with earthy or silicious substances.

The process described in this application relates to a process somewhat similar to the process described and claimed in a copending application filed by us of even date with this application and serially numbered 200,649.

In general the soluble compounds we employ are typified by ordinary soaps, from which the fatty or resin acids are liberated by the addition of a suitable mineral acid and which fatty or resin acids are again rendered completely soluble by the addition of an equivalent of caustic alkali.

In carrying out our invention the suitably-crushed ore is suspended in water, and to the mixture an addition of a small quantity of soap solution is made. A small amount of mineral acid is then added, which decomposes the soluble soap or other similar compound by uniting with the alkaline base thereof, thus liberating in a state of chemical subdivision the fatty or resin acid or other compound, such as cresol, &c., in intimate contact with the suspended ore particles. It is found that the liberated acids, &c., which may even be solid under ordinary conditions, are precipitated and adhere to the sulfureted minerals or to sulfur, graphite, or free metals present in the ore, leaving the gangue or earthy particles preferentially wet by water and free from adhesions of fatty acid and the like. The fatty acid and the like used for the purpose of adhering to the mineral particles is thus produced *in situ* throughout the suspended ore mass in the most intimate contact or admixture therewith, and the mineral particles become attached to or more or less coated by films of fatty or resin acid. The mixture containing water, fatty or resin acid, metalliferous particles, and gangue is now thoroughly agitated, and the coated metalliferous particles adhere together and form granules or small agglomerate masses, which partly by reason of gravity and partly on account of their bulk, as compared with the individual grains of gangue, may be readily separated in up-currents or by other suitable classification apparatus. This process may conveniently be rendered continuous by feeding ore-pulp, soap solution, and mineral acid continuously into one or more agitating vessels and discharging the products of agitation into an up-current separator, which allows the metalliferous granules to fall to the bottom of the vessel, while the particles of gangue are carried away by an upward stream.

The apparatus employed may be of the type described in Cattermole's United States Patent No. 763,260.

After separation of the coated mineral particles the recovered mineral concentrate is subjected to the action of a suitable amount of caustic or carbonated alkali, whereby the fatty or resin acid, &c., recombines completely with the alkali, forming a readily-soluble soap or alkaline compound. After draining this off and washing with water, if necessary, the mineral particles are left clean and free from soap. The resulting solution thus contains all the soap or equivalent compound originally used in a state ready for immediate employment in the separation of mineral from fresh quantities of ore, and the process becomes completely cyclic with regard to the soap employed.

Throughout the operation the same soap or similar compound is used, the constituent whereof may be quite solid under ordinary conditions, the only additions required being

small quantities of mineral acid and alkali for the decomposition and recomposition of this agent during the cycle of operations.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. The herein-described process of concentrating ores which consists in mixing the ore-pulp with a soap solution and a mineral acid so as to liberate from the soap the organic acid which coats the desired mineral particles but not the gangue, agitating the mixture so as to agglomerate the coated mineral particles into granules and separating the granules from the non-coated gangue.

2. The herein-described process of concentrating ores which consists in mixing the ore-pulp with a soap solution and a mineral acid which liberates the organic acid from the soap, agitating the mixture so as to agglomerate the coated mineral particles into granules, separating the granules from the non-coated gangue and adding alkali to the granules to reproduce the soluble soap.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

ARTHUR EDWARD CATTERMOLE.
HENRY LIVINGSTONE SULMAN.
HUGH FITZALIS KIRKPATRICK-PICARD.

Witnesses:
FREDERICK READ,
F. B. BYNG.

2143

No. 788,947. Patented April 25, 1905.

UNITED STATES PATENT OFFICE.

ARTHUR EDWARD CATTERMOLE, HENRY LIVINGSTONE SULMAN, AND HUGH FITZALIS KIRKPATRICK-PICARD, OF LONDON, ENGLAND.

ORE CONCENTRATION.

SPECIFICATION forming part of Letters Patent No. 788,947, dated April 25, 1905.

Application filed March 30, 1904. Serial No. 200,649.

To all whom it may concern:

Be it known that we, ARTHUR EDWARD CATTERMOLE, HENRY LIVINGSTONE SULMAN, and HUGH FITZALIS KIRKPATRICK-PICARD, subjects of the King of England, residing at London, England, have invented certain new and useful Improvements in Ore Concentration, of which the following is a specification.

Our process has for its object the separation of minerals from the silicious or earthy matters of ores by means of soaps or similar compounds, and is dependent upon the superior physical attraction exhibited by minerals for fatty or resin acids or for certain other aromatic derivatives—such as cresols, phenols, &c.—which form soluble salts or compounds with alkaline hydrates, as compared with earthy or silicious substances.

The process described in this application relates to a process somewhat similar to the process described and claimed in a copending application filed by us of even date with this application and serially numbered 200,650.

In general the soluble compounds we employ are typified by ordinary soaps, from which the fatty or resin acids are liberated by the addition of a suitable mineral acid and which fatty or resin acids are again rendered completely soluble by the addition of an equivalent of caustic alkali.

In carrying out our invention the suitably-crushed ore is suspended in water, and to the mixture an addition of a small quantity of soap solution is made. A small amount of mineral acid is then added, which decomposes the soluble soap or other similar compound by uniting with the alkaline base thereof, thus liberating in a state of chemical subdivision the fatty or resin acid or other compound, such as cresol, &c., in intimate contact with the suspended ore particles. It is found that the liberated acids, &c., which may even be solid under ordinary conditions are precipitated and adhere to the sulfureted minerals or to sulfur, graphite, or free metals present in the ore, leaving the gangue or earthy particles preferentially wetted by water and free from adhesions of fatty acid and the like. The fatty acid and the like used for the purpose of adhering to the mineral particles is thus produced *in situ* throughout the suspended ore mass in the most intimate contact or admixture therewith. The mineral particles now attached to or more or less coated or inclosed by films of fatty or resin acids and the like are capable of being separated from the gangue or earthy particles by various methods dependent upon this altered physical condition. For example, the coated mineral particles may be removed by generating gaseous bubbles in the mixture which preferentially attach themselves to the fatty or similar acid-coated particles and raise them to the surface of the pulp, whence they may be removed by skimming or the like. If the ore contains a carbonate, any small excess of the acid used to decompose the soap or similar alkaline compound will also liberate bubbles of carbonic acid, which will attach themselves to the fatty acid-coated mineral particles and float them to the surface, or a suitable carbonate (or other substance capable of liberating a gas on the addition of a suitable acid, such as an easily decomposable sulfid, &c.) may be initially added to the ore mass for such purpose, or the mineral particles may be caused to adhere to metallic or other suitable surfaces coated with similar fatty acids, or, finally, the coated mineral particles may be caused to adhere to wood, sawdust, or other suitable material lighter than water coated with similar fatty acids, &c., which can then be removed by flotation, in each case leaving the mineral-free gangue particles capable of rejection. After separation of the coated mineral particles by any of the methods before mentioned the recovered mineral concentrate is subjected to the action of a suitable amount of caustic or carbonated alkali, whereby the fatty or resin acid, &c., recombines completely with the alkali, forming a readily soluble soap or alkaline compound. After draining this off, and washing with water, if necessary, the mineral particles are left clean and free from soap. The resulting solution thus contains all the soap or equivalent compound originally used

in a state ready for immediate employment in the separation of mineral from fresh quantities of ore, and the process becomes completely cyclic with regard to the soap employed.

Throughout the operation the same soap or similar compound is used, the constituent whereof may be quite solid under ordinary conditions, the only additions required being small quantities of mineral acid and alkali for the decomposition and recomposition of this agent during the cycle of operations.

What we claim as our invention, and desire to secure by Letters Patent, is

1. The herein-described process of concentrating ores which consists in mixing a freely-flowing ore pulp with a soap solution and a mineral acid so as to liberate the organic acid from the soap throughout the suspended ore mass in intimate contact therewith, whereby the organic acid coats the desired mineral particles and not the gangue, and thereafter separating the coated mineral matter from the non-coated gangue.

2. The herein-described process of concentrating ores which consists in mixing the ore pulp with a soap solution and a mineral acid which liberates the organic acid from the soap, separating the coated mineral matter from the non-coated gangue and adding alkali to the coated mineral matter to reproduce the soluble soap.

3. The herein-described process of concentrating ores which consists in mixing a freely-flowing ore pulp with a soap solution and a mineral acid so as to liberate the organic acid from the soap throughout the suspended ore mass in intimate contact therewith, bringing the liquor into intimate contact with a gas which will adhere to the coated particles and separating out the coated mineral matter which floats.

4. The herein-described process of concentrating ores which consists in mixing the ore pulp with a soap solution and a mineral acid which liberates the organic acid from the soap, bringing the liquor into intimate contact with a gas, separating out the coated mineral matter which floats and adding thereto an alkali which reproduces the soluble soap.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

ARTHUR EDWARD CATTERMOLE.
HENRY LIVINGSTONE SULMAN.
HUGH FITZALIS KIRKPATRICK-PICARD.

Witnesses:
T. B. BUSS,
FREDERICK READ.

No. 793,808. PATENTED JULY 4, 1905.

H. L. SULMAN & H. F. KIRKPATRICK-PICARD.

ORE CONCENTRATION.

APPLICATION FILED OCT. 3, 1903.

3 SHEETS-SHEET 1

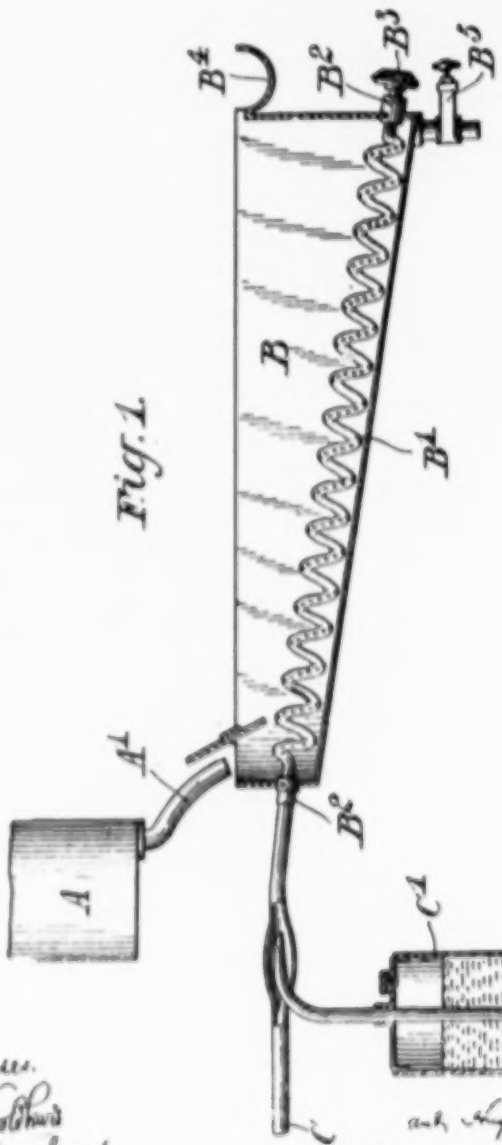


Fig. 1.

Witnesses.
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J. M. Stymkoop

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By Kenyon Kirkpatrick & Co
Attys.

No. 793,808. PATENTED JULY 4, 1905.

H. L. SULMAN & H. F. KIRKPATRICK-PICARD.

ORE CONCENTRATION.

APPLICATION FILED OCT. 5, 1903.

3 SHEETS—SHEET 2.

2147

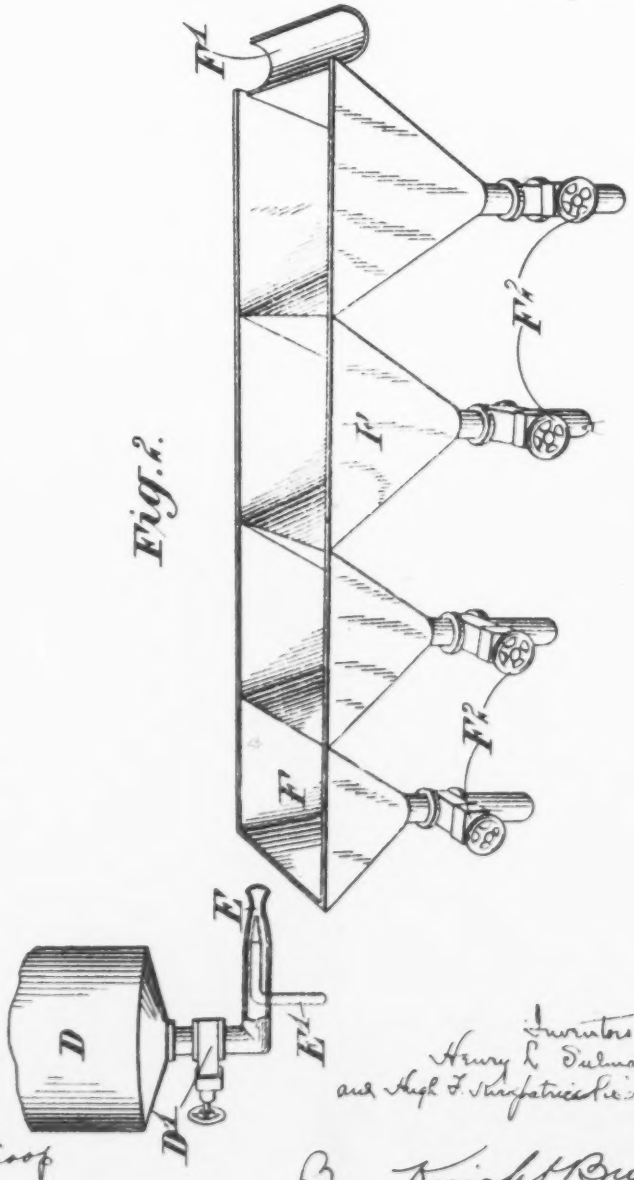

Fig. 2.

Witnesses:
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By Knight Bros
Attys

No. 793,808. PATENTED JULY 4, 1905.

H. L. SULMAN & H. F. KIRKPATRICK-PICARD.

ORE CONCENTRATION.

APPLICATION FILED OCT. 5, 1903.

3 SHEETS—SHEET 3.

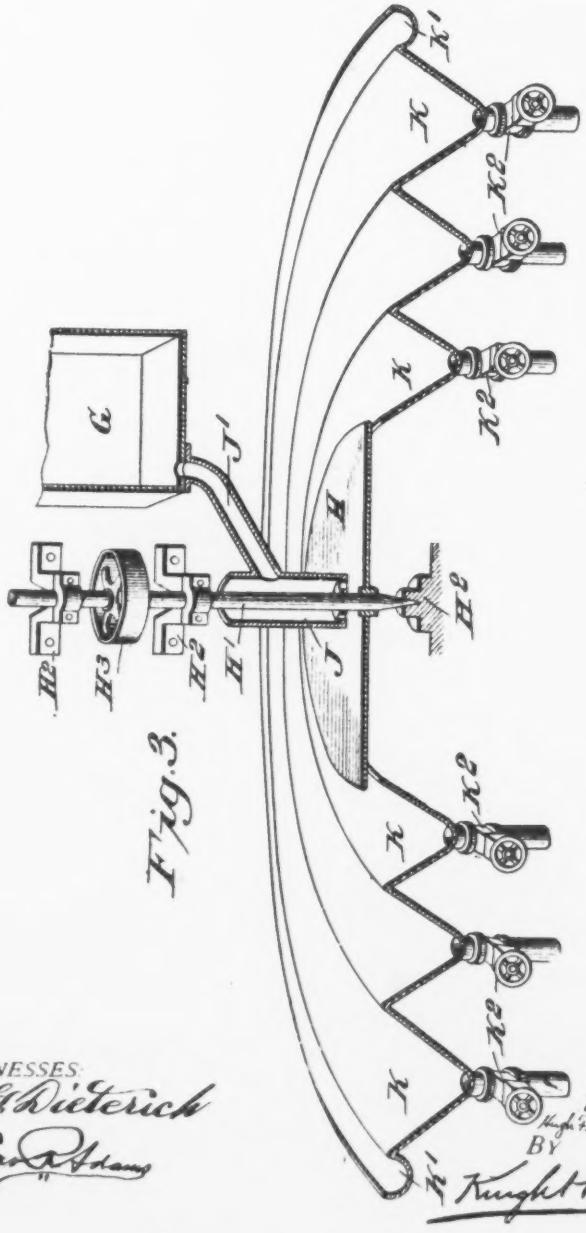

Fig. 3.

WITNESSES:
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No. 793,808. Patented July 4, 1905.

UNITED STATES PATENT OFFICE.

HENRY LIVINGSTONE SULMAN AND HUGH FITZALIS KIRKPATRICK-PICARD, OF LONDON, ENGLAND.

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ORE CONCENTRATION.

SPECIFICATION forming part of Letters Patent No. 793,808, dated July 4, 1905.

Application filed October 5, 1903. Serial No. 176,871.

To all whom it may concern:

Be it known that we, HENRY LIVINGSTONE SULMAN and HUGH FITZALIS KIRKPATRICK-PICARD, subjects of the King of England, residing at London, England, have invented certain new and useful Improvements in or Relating to Ore Concentration, of which the following is a specification.

The present invention relates to the concentration of ores by separation of the metalliferous constituents and graphite, carbon, sulfur, and the like from the gangue by means of oils, grease, tar, or any similar substance which has a preferential affinity for metalliferous matter over gangue.

According to this invention we utilize the power which is possessed by films or bubbles of air or other gas of attaching themselves to solid particles moistened by oil or the like.

According to one method of carrying out our invention suitably-crushed ore is suspended in water. To this suspension a proportion of oil, grease, or tar (hereinafter referred to as "oil") is added and duly mixed with the mass by any suitable means in quantity insufficient to raise the oiled mineral by virtue of the flotation power of the oil alone. A suitable gas is now generated in or introduced into the mixture, such as air, carbonic acid gas, sulfureted hydrogen, or the like. For example, bicarbonates or carbonates, either soluble or insoluble in water (preferably the latter) or easily-decomposable sulfids and the like may be used with acid solution. In such cases, if desired, the addition of acid may be made to the mixture after the addition of the gas-producing reagent. In the case of solutions containing free alkali the addition of acid sufficient to neutralize this must be made before the gas is produced. If desirable, gaseous bubbles may be produced by electrolytic methods or by means of various other known reactions.

According to another method of carrying out this invention the oil is not added alone; but the pulp is submitted to the action of a current of air or other gas bubbles, the air or other gas being first suitably charged either with the vapor of a v such as petroleum of low boiling-point, or with the spray of any other suitable volatile or non-volatile or fixed oil or the like. The oil may be sprayed or reduced to a state of such fine division that minute globules of the same can remain temporarily suspended in an air or other gas current by the use of any suitable spraying or atomizing device and the air-current introduced into the ore-pulp, preferably at the bottom, by means of a pipe or pipes provided with suitable perforations or by other suitable contrivance. The minute oil globules or the condensed vapors or volatile oils attach themselves to the metalliferous particles in preference to the gangue.

The oiled metalliferous particles resulting from either of the processes above described have the power of attaching to themselves with a greater comparative strength than the gangue particles the films or bubbles of gas which exist in the mass and are thus raised to the surface of the liquor by gaseous flotation. They can then be removed by skimming or other suitable means. The gangue particles unwetted by oil or grease are not floated up with the oiled mineral particles, and thus in the main remain at the bottom of the vessel containing the mixture. The oil can then be removed from the oiled mineral by any suitable known means.

In the case in which oil-spray is used the temperature of the mass of pulp may be varied to secure the best results with spray of oils of varying viscosity. Instead of suspending the oil-spray in an air-supply system suitably-devised atomizing-jets operated by air or a jet of steam and air may be introduced directly into the pulp. The gas used may be other than air, such as carbonic acid, steam, or mixtures of these. We have also found that a particle of metalliferous mineral if coated with a minute film of oil, grease, or the like then exposed to air will not readily sink in water. It is therefore unnecessary in some instances to employ gaseous bubbles to effect flotation. For example, according to an alternative method for effecting the separation of metalliferous matter from gangue the metalliferous ore-pulp is i ixed

in any suitable manner with a small proportion of oil and then sprayed in as finely divided a state as necessary through air by means of jets, revolving disks, or otherwise, and the sprayed product is then allowed to fall upon the surface of water. The gangue particles wetted only with water at once sink, while the metalliferous particles coated with a thin film of oil and after exposure to air float on the surface of the water and may be removed by skimming or other suitable means. Before bringing the pulp into the necessary contact with air it will be obvious that the bulk of the water may first be removed by subsidence or any other suitable means.

In the accompanying drawings, Figure 1 is a diagram in longitudinal section of an apparatus suitable for carrying out this process. Fig. 2 is a diagram in perspective, partly in section, of another form of suitable apparatus; and Fig. 3 is a diagram in perspective, partly in section, of an alternative form of apparatus.

Referring to Fig. 1, A is a tank for pulp, which delivers through a pipe A′ to a concentrating-tank B, the bottom of which slopes downward from the inlet. The tank B is provided at the bottom with a coiled pipe B′, suitably perforated, supported in bearings B^2, and arranged to be rotated by means of a spur-wheel B^3 or the like. Air is forced into this pipe B′ through a pipe C, and oil is simultaneously introduced into the pipe C from carbureter or the like C′. At the end of the tank B farthest from the pulp-inlet a launder B^4 is placed to receive the discharge of floating material, and an outlet-tap B^5 is provided at the lowest point of the tank.

Referring to Fig. 2, D is a tank in which pulp and oil are mixed, and the mixture passes through an outlet-tap D′ to an ejector E, through which air under pressure is passed by the pipe E′. The spray of pulp, oil, and air falls into a tank F, filled with water and consisting of a series of communicating pointed boxes, which increase in depth from the inlet end. A launder F′ is provided at the outlet end of the tank, and outlet-taps F^2 are placed at the lowest points of the boxes.

Referring to Fig. 3, G is a tank in which pulp and oil are mixed. H is a circular disk attached to a vertical spindle H′, supported in bearings H^2 and arranged to be rotated through a driving-pulley H^3 or the like. Surrounding the spindle is a cylindrical collar J, connected with the tank G by a pipe J′, so that the pulp and oil are fed through the collar to the rotating disk. Surrounding the disk is a series of annular pointed troughs K, communicating with one another and increasing in depth toward the outside and filled with water. A launder K′ is provided at the periphery of the outside trough to receive the discharged floating material, and outlet-taps K^2 are placed at the lowest points of the troughs.

This process has been described as applied to ore concentration by oil; but it is to be understood that it is equally applicable to concentration by the use of any other substance which has an affinity for metalliferous matter.

We claim—

1. The herein-described process of concentrating ores which consist in bringing the pulp into intimate contact with "oil" in the form of spray and with a gas and thereafter separating the metalliferous constituents from the gangue.

2. The herein-described process of concentrating ores which consists in bringing the pulp into intimate contact with "oil" disseminating the mixture through air and thereafter separating the metalliferous constituents from the gangue in water.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

HENRY LIVINGSTONE SULMAN.
HUGH FITZALIS KIRKPATRICK-PICARD.

Witnesses:
CLAUDE C. R. MCKENZIE,
WALTER J. SKERTEN.

UNITED STATES PATENT OFFICE.

ALFRED SCHWARZ, OF NEW YORK, N. Y., ASSIGNOR TO SCHWARZ ORE TREATING COMPANY, OF PHŒNIX, ARIZONA TERRITORY, A CORPORATION OF ARIZONA TERRITORY.

PROCESS OF CONCENTRATING ORES.

No. 807,601. Specification of Letters Patent. Patented Dec. 19, 1905.

2151 Application filed April 19, 1905. Serial No. 256,487.

To all whom it may concern.

Be it known that I, ALFRED SCHWARZ, a subject of the Emperor of Germany, and a resident of the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Processes of Concentrating Ores, of which the following is a specification.

In the concentration of ores by the employment of hydrocarbons as adhesive agents it has been observed that sulfids yield better results than oxids, carbonates, and chlorids. In fact, so far as known to me, a practical application of such process before my inventions relating to this art has been largely, if not wholly, confined to sulfid ores.

The object of the present invention is to extend the application of hydrocarbon concentrating processes to ores heretofore considered unworkable by first converting such ores into sulfids, preferably by a wet method, to thereby preserve the mass of ore in its crushed condition and suitable for treatments according to known methods.

In carrying out the present invention I proceed by preparing a soluble sulfid in any well-known manner—for example, by dissolving sulfur in an aqueous solution of potassium or sodium hydrate, the sulfur being added in sufficient quantity to give the desired reaction. The pulverized ore containing the mineral in the form of oxid, carbonate, or chlorid is then mixed in a suitable vessel with the sulfid solution, the mass being either cold or heated by suitable means and the vessel provided with an agitator to effect a thorough and intimate mixture. During this operation the oxid, carbonate, or chlorid is converted into a sulfid by the action of the potassium or sodium sulfid, a form which is capable of subsequent practical treatment with hydrocarbons for the separation of the values from the earthy or rocky constituents of the ore. As the action of the hydrocarbon on the metallic constituents of the ore is a surface action, it is unnecessary to proceed so far as to convert the entire mass of the particles of oxid, carbonate, or chlorid into a sulfid, it being sufficient if the surface of the particles is so converted, as thereby there is presented all that is necessary for the desired action of the hydrocarbon.

After the initial conversion, as above described, the ore may be concentrated by any suitable treatment with a hydrocarbon, and for such purpose I may use a hydrocarbon which is normally liquid or one which is solid at normal temperatures, or the latter in admixture with the former, as described in my applications Serial Nos. 210,137, 210,138, 225,370, and 231,395, and United States Patent No. 771,277. Of hydrocarbons which are solid at normal temperatures and required to be melted there may be used paraffin or ozocerite, or a resinous hydrocarbon, such as resin, pitch, or asphaltum. Of normally liquid hydrocarbons there may be used any suitable vegetable, animal, or mineral oil. These hydrocarbons may be used singly or in combination of two or more, it being understood that the constitution of the adhesive agent will depend upon the character of the ore to be treated, varying as the ore varies.

Ore either in a dry or wet condition is mixed in any suitable vessel having an agitator with the hydrocarbon, sufficient quantity being added to effect the desired separation. If the hydrocarbon is one which is solid at normal temperatures, it is first melted and then stirred in with the ore, the mixture being effected by any suitable mechanical means and, if desired, air, steam, or gas may be injected into the mass either alone or to assist the mechanical agitation. The injection of such gaseous agent results in the hydrocarbon taking up an appreciable quantity of air or gas, giving a certain sponginess which increases its floating power.

As a specific example of my invention I have used as an adhesive agent a mixture of paraffin and resin, heat being employed if necessary to maintain this compound in a melted condition after it has been mixed with the ore.

After an intimate mixture with all parts of the ore has been effected the mass is subjected to the action of water heated to any desired temperature, even as high as the boiling-point, whereby the earthy or rocky constituents are liberated and washed out and settle in the bottom of the vessel. The metallic constituents of the ore having united with the adhesive agent may be skimmed or

screened off and run to a centrifugal drier for the separation or recovery of the concentrates from the adhesive agent.

Instead of subjecting the mass to the action of heated or boiling water cold water, preferably under pressure, may be injected into the mass, the effect of which is to solidify or granulate the adhesive agent, which with the entrapped metallic constituents may be floated or screened off, while the tailings being saturated with water will be precipitated more or less completely to the bottom of the vessel. By subjecting the mass to heat in a suitable vessel the adhesive agent is melted and the concentrates may be separated and recovered therefrom by a centrifugal drier, filter-press, or other means. The mass of ore and adhesive agent may first be treated with heated or boiling water and subsequently treated with cold water. Also during the treatment with water, which may be made acid or alkaline, if desired, the mass may be agitated mechanically or by the injection of air, steam, or gas.

The concentrates, if necessary, may be washed with a solution of potassium or sodium hydrate to remove any remaining portions of the adhesive agent.

While I have described in giving a specific method of procedure the use of a mixture of paraffin and resin, I may use either one of these singly, the successive steps of the operation being the same, or I may use singly a normally liquid hydrocarbon, following the same method of operation except in such case there will of course be no solidification or granulation of the hydrocarbon. When using a normally liquid hydrocarbon, the mass may be treated either with cold or heated water to effect the separation of the adhesive agent with the metallic constituents of the ore from the tailings.

The essential feature of the present invention is the conversion of an ore of the character above specified into a sulfid to adapt it for treatment by a hydrocarbon, the particular method of concentrating by the employment of a hydrocarbon being varied according to known methods as may be desired or suitable to the particular ore, and while I have given specific examples I do not wish to be wholly restricted thereto.

In carrying out the conversion above described I use an excess of sulfur above the theoretical quantity necessary to effect the change of oxid, carbonate, or chlorid to sulfid.

What I claim, and desire to secure by Letters Patent, is—

1. The method of treating ores which consists in subjecting a non-sulfid ore to the action of a soluble sulfid to convert the mineral into a sulfid, then treating the mass with a hydrocarbon and finally separating the hydrocarbon with the entrapped metallic constituents of the ore from the tailings

2. The method of treating an ore containing non-sulfid mineral by subjecting the same to the action of an alkaline sulfid to convert the mineral into a sulfid, then treating the mass with a hydrocarbon and finally separating the hydrocarbon with the entrapped metallic constituents of the ore from the tailings.

3. The method of treating an ore containing non-sulfid mineral by subjecting the same to the action of an aqueous solution of potassium or sodium sulfid to convert the mineral into a sulfid, then treating the mass with a hydrocarbon and finally separating said hydrocarbon with the entrapped metallic constituents of the ore from the tailings.

4. The method of treating an ore containing non-sulfid mineral by subjecting the same to the action of a soluble sulfid, then treating the resulting metallic sulfid with a melted hydrocarbon which is solid at normal temperatures and finally separating said hydrocarbon with the entrapped metallic constituents from the tailings.

5. The method of treating an ore containing non-sulfid mineral by subjecting the same to the action of a soluble sulfid, then treating the resulting metallic sulfid with a compound of melted paraffin and resin, then separating said compound with the entrapped metallic constituents from the tailings.

In testimony whereof I have hereunto signed my name in the presence of two subscribing witnesses,

ALFRED SCHWARZ.

Witnesses:
E. F PORTER.
ALEXANDER RODMAN

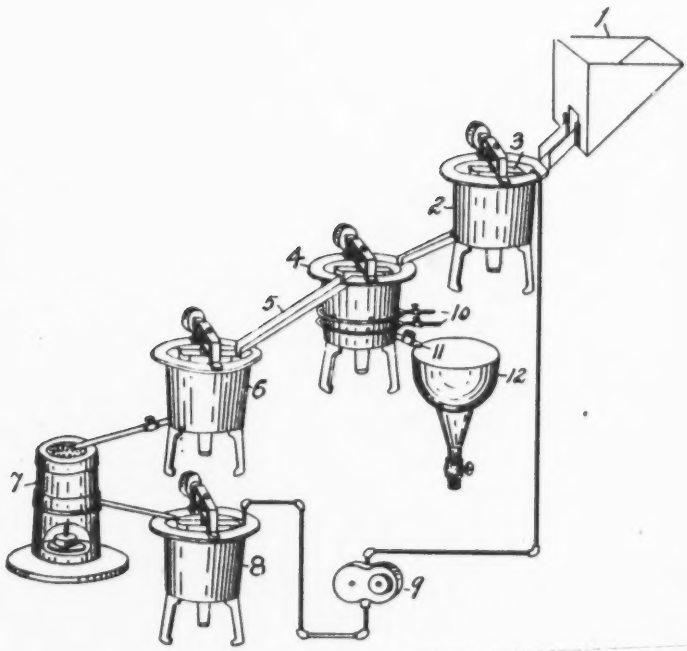
No. 807,503. PATENTED DEC. 19, 1905.

A. SCHWARZ.

PROCESS OF CONCENTRATING ORES.

APPLICATION FILED MAY 27, 1904.

2154



WITNESSES.

Grace D. Hesley

Harry Schwarz

INVENTOR

Alfred Schwarz

BY

Charles D. Jones.

HIS ATTORNEY

UNITED STATES PATENT OFFICE.

ALFRED SCHWARZ, OF NEW YORK, N. Y., ASSIGNOR TO THE SCHWARZ ORE TREATING COMPANY, OF PHŒNIX, ARIZONA TERRITORY, A CORPORATION OF ARIZONA TERRITORY.

PROCESS OF CONCENTRATING ORES.

No. 807,503. Specification of Letters Patent. Patented Dec. 19, 1905.

Application filed May 27, 1904. Serial No. 210,138.

To all whom it may concern:

Be it known that I, ALFRED SCHWARZ, a subject of the German Emperor, and a resident of the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Processes of Concentrating Ores, of which the following is a specification.

My invention has for its object the concentration of ores by the selective action of a hydrocarbon compound.

Heretofore the separation of the values in ores has been effected by mixing the pulverized ore with a product resulting from the distillation of petroleum, the ore having been previously mixed with sufficient water to form a freely-flowing pulp. The oil in such method exercises the property of attaching itself to and buoying up the metallic constituents of the ore that are suspended in the pulp; but it has little or no effect upon the earthy constituents. I have found that the efficiency of the selective action of oils generally, either mineral, vegetable, or animal, is increased by the addition thereto of a fatty matter which is solid at normal temperatures, as paraffin, stearin, or palmitin.

In carrying out my invention I proceed as follows: The ore is first crushed and screened to a convenient size for working and is then thoroughly and intimately mixed with the selective material, which in this instance is a compound of a mineral, vegetable, or animal oil and a fatty matter of the character above specified, such mixture being solid at normal temperatures. Such material may be readily prepared by dissolving the fatty matter in the oil medium, heat being employed to melt the fatty matter, if necessary, and to maintain the compound in a liquid condition during its incorporation with the pulverized ore. As a specific example of a selective material I prefer crude petroleum or any of its products, to which is added about nine to ten per cent., by weight, of paraffin, such proportion having been found to give good results with a copper-sulfid ore.

Any suitable apparatus may be employed to effect the mixture of the ore and selective material, all that is essential being a vessel provided with agitating-blades. In such vessel the ore is mixed with sufficient of the selective material to make a thick pasty mass, the agitation being continued long enough to bring the selective material into intimate contact with all portions of the ore. The vessel may be steam-jacketed or otherwise suitably heated if found necessary to maintain the selective material in a liquid condition. After a complete incorporation of the selective material with the ore water, preferably under pressure, is injected into the mass by suitably-arranged pipes and agitation continued until the water is distributed throughout the mass. The mass is then allowed to subside, when the selective material, with the entrapped metallic constituents of the ore, will rise to the top and may be removed in any suitable manner, as by floating over the top of the vessel. The values may be separated from the selective material in any suitable or well-known manner—as, for example, by a centrifugal drum or filter-press. The tailings, being unaffected by the selective material, will remain in the water and settle to the bottom of the vessel, from which they may be drawn off and, if necessary, subjected to further treatment for the recovery of any values they may contain.

In the concentration of ores by the selective action of the compound above described the action is facilitated and better results secured by the injection of a gaseous fluid—such as air, steam, or gas as carbon-dioxid gas—into the mass. This may be done by suitably-arranged pipes leading into the bottom or sides of the vessel, the effect of such use of air, steam, or gas being to break up and subdivide the mass in a complete and thorough manner. Furthermore, it results in the selective material taking up an appreciable quantity of air or gas, giving a certain amount of sponginess, which increases its floating power. After the admission of water, which may be done by suitably-arranged pipes, the admission of air, steam, or gas may be continued to assist in distributing the water throughout the mass and to effect a thorough separation and washing out of the tailings.

In referring to paraffin as a "fatty matter" it is to be understood that I do so in a popular and not a chemical sense. It is also to be understood that the proportions of the ingredients of the selective material may be varied to suit the particular ore treated.

The accompanying drawing shows in perspective one arrangement of apparatus by which the process may be carried out.

1 designates a bin or hopper from which the pulverized ore is discharged into a vessel 2, which is preferably steam-jacketed and provided with an agitator 3. In this vessel the ore and selective agent are intimately mixed, and from said vessel the mass is discharged into a vessel 4, provided with an agitator in which it is treated with water slightly acidulated, if desired, to effect the separation of the selective agent, with the entrapped metallic constituents, from the tailings. If cold water is employed, the selective agent will be solidified and rising to the top is conducted by a trough 5 to a remelting and storage vessel 6. If heated or boiling water is employed in the vessel 4, the selective agent will be maintained in its liquid condition and as it rises with the entrapped metallic constitutents is run by the trough 5 into the storage vessel 6 and from the latter to a centrifugal-drum 7 for the separation of the values from said agent. The recovered agent is collected in a storage vessel 8, from which it may be raised to the mixing vessel 2 by a pump 9. The separating vessel 4 is provided with suitable pipes 10 for the admission of air, steam, or gas and with a pipe 11 by which the tailings may be discharged into a vessel 12. After removal of the values from the separator 7 they may be subjected to any suitable treatment.

What I claim, and desire to secure by Letters Patent, is—

1. The process of concentrating ores consisting in mixing with the pulverized ore a selective agent consisting of a mixture of a liquid hydrocarbon and a normally solid fatty matter which mixture is solid at normal temperatures, separating said agent with its entrapped values from the tailings, and finally recovering the values from the selective agent.

2. The process of concentrating ores consisting in mixing with the pulverized ore a selective agent consisting of a mixture of a liquid hydrocarbon and a normally solid fatty matter which mixture is solid at normal temperatures, treating the mass with water to separate said agent with its entrapped values from the tailings, and finally recovering the values from the selective agent.

3. The process of concentrating ores consisting in mixing with the pulverized ore a selective agent consisting of a mixture of a liquid hydrocarbon and a normally solid fatty matter which mixture is solid at normal temperatures, treating the mass with cold water to separate said agent with its entrapped values from the tailings, and finally recovering the values from the selective agent.

4. The method of concentrating ores consisting in mixing with the pulverized ore a selective agent consisting of a mixture of a liquid hydrocarbon and a normally solid fatty matter which mixture is solid at normal temperatures and subjecting the mass to the action of a gaseous fluid, separating the selective agent with its entrapped values from the tailings, and finally recovering the values from the selective agent.

5. The process of concentrating ores consisting in mixing with the pulverized ore a selective agent consisting of a mixture of a liquid hydrocarbon and paraffin which mixture is solid at normal temperatures, separating said agent with its entrapped values from the tailings, and finally recovering the values from the selective agent.

6. The process of concentrating ores consisting in mixing with the pulverized ore a selective agent consisting of a mixture of a liquid hydrocarbon and paraffin which mixture is solid at normal temperatures, treating the mass with water to separate said agent with its entrapped values from the tailings, and finally recovering the values from the selective agent.

In testimony whereof I have hereunto signed my name in the presence of two subscribing witnesses.

ALFRED SCHWARZ.

Witnesses:
F. F. PORTER,
CHARLES S. JONES.

No. 809,959. PATENTED JAN. 16, 1906.

E. B. KIRBY.

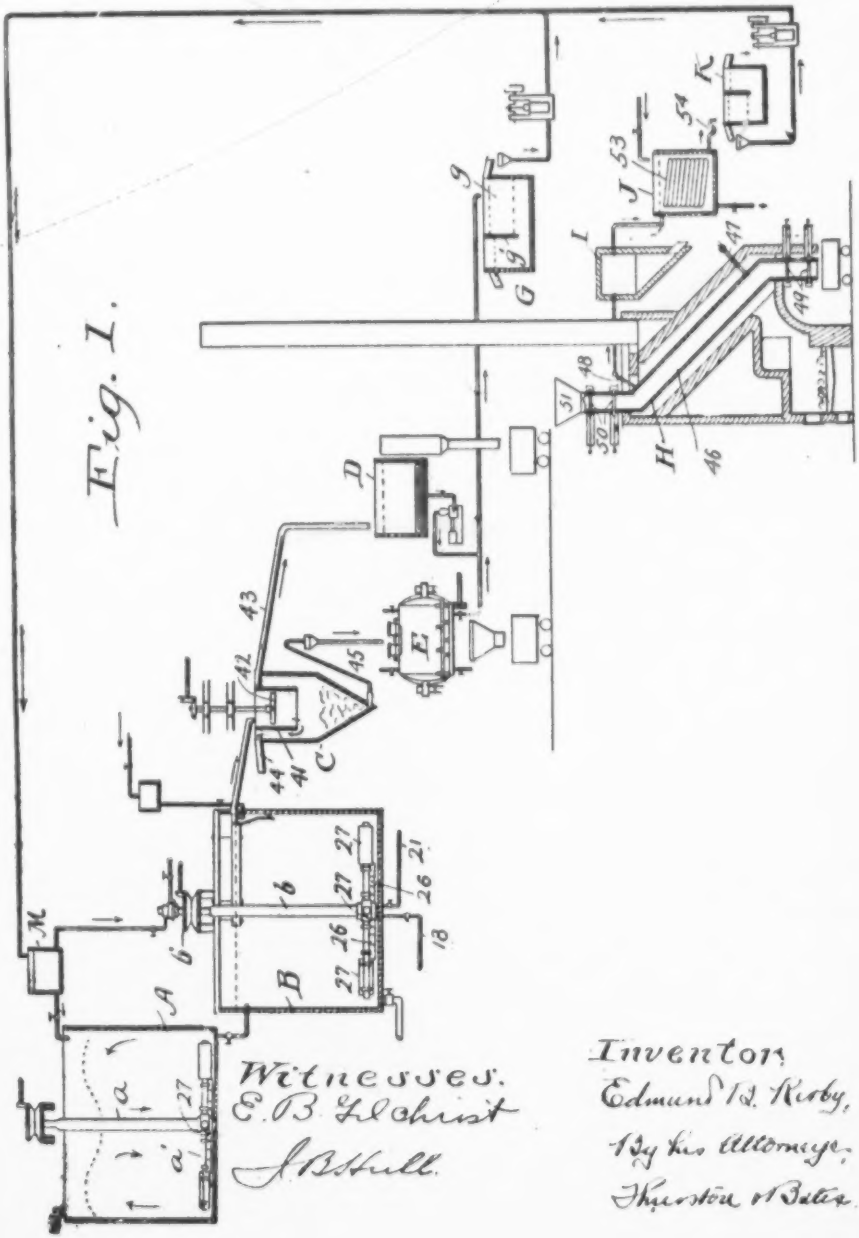
PROCESS OF SEPARATING MINERALS.

APPLICATION FILED DEC. 14, 1903.

2158

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses.
E. B. Kirby
J. B. Hull.

Inventor,
Edmund B. Kirby,
By his Attorneys,
Thurston & Bates.

No. 809,959 .PATENTED JAN. 16, [illegible].

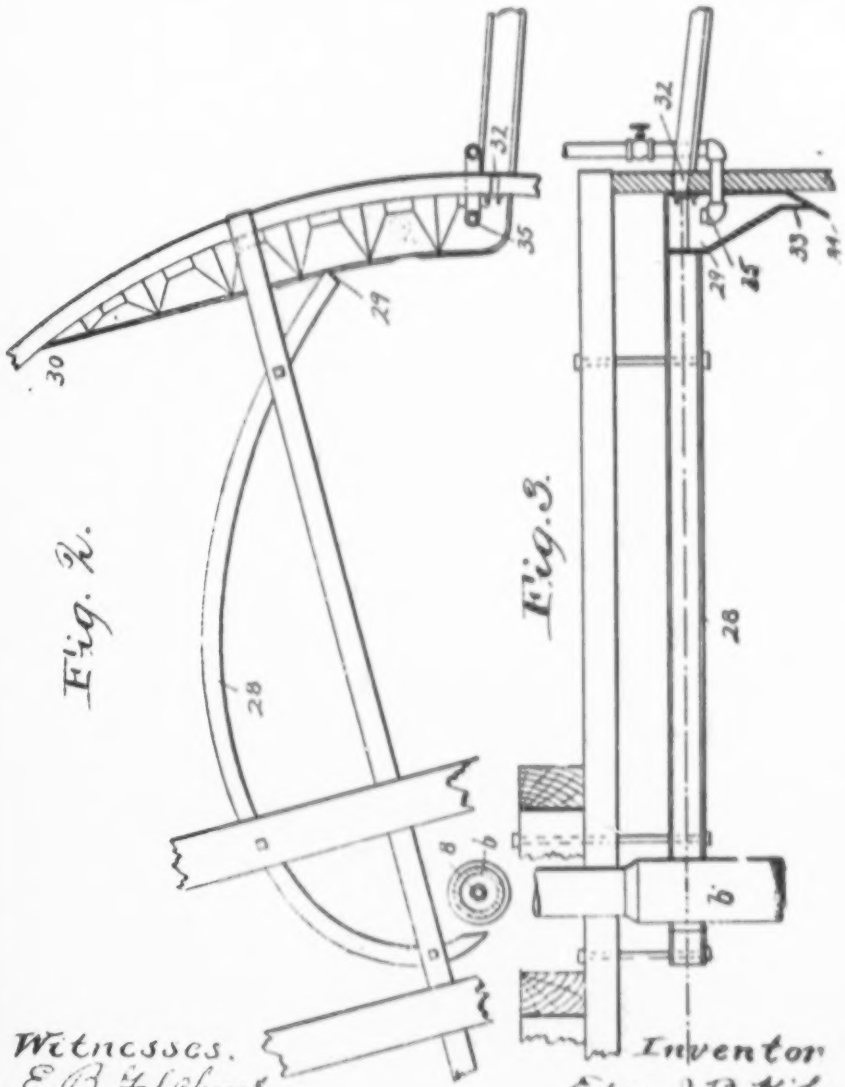
E. B. KIRBY.

PROCESS OF SEPARATING MINERALS.

APPLICATION FILED DEC. 14, 1903.

[illegible] SHEETS—SHEET 4

2159



Witnesses.
E. B. Fitchett
J. B. Stull

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By his Attorneys,
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No. 809,959. PATENTED JAN. 16, 1906.

E. B. KIRBY.

PROCESS OF SEPARATING MINERALS

APPLICATION FILED DEC. 14, 1903.

3 SHEETS—SHEET 3.

2730

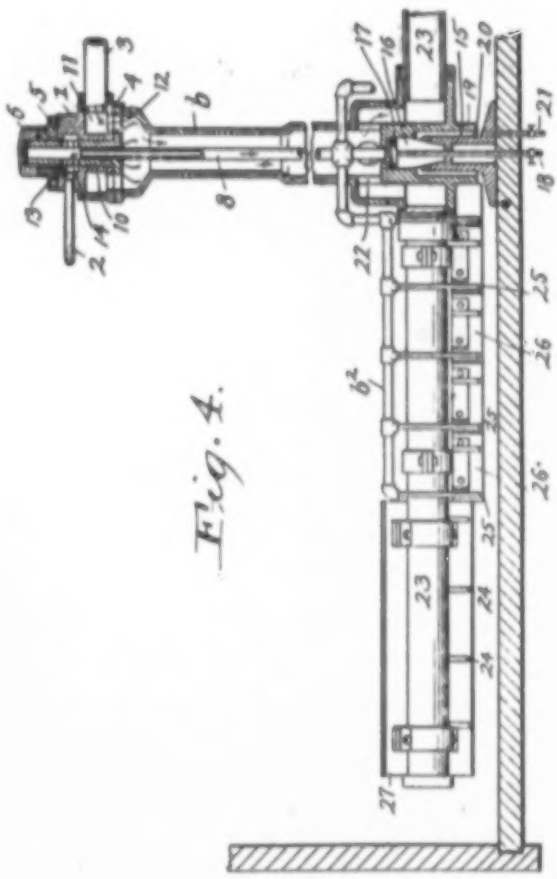


Fig. 4.

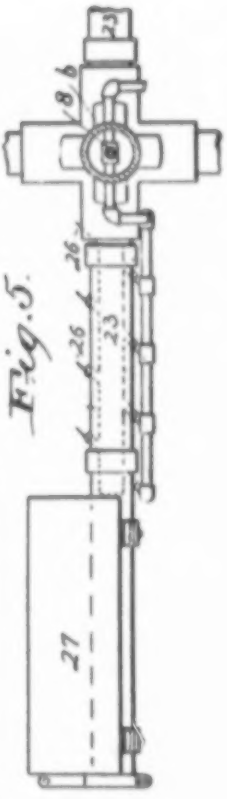


Fig. 5.

Witnesses.
E. B. Gilchrist
J. B. Hull

Inventor:
Edmund B. Kirby,
By his Attorneys,
Thurston & Betts

UNITED STATES PATENT OFFICE.

EDMUND B. KIRBY, OF ROSSLAND, CANADA.

PROCESS OF SEPARATING MINERALS.

No. 809,959. Specification of Letters Patent. Patented Jan. 16, 1906.

Application filed December 14, 1903. Serial No. 185,023.

To all whom it may concern:

Be it known that I, EDMUND B. KIRBY, a citizen of the United States, residing at Rossland, in the Province of British Columbia and Dominion of Canada, have invented a certain new and useful Improvement in Process of Separating Minerals, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

The invention relates to the concentration of ores. It may be employed to separate the metallic minerals from the gangue, or to separate certain of the metallic minerals from others, or from others and the gangue.

The operation of the process is dependent upon the fact that, because of differences in physical characteristics of the various constituents of mineral material, such constituents show preferences of adhesion between two commingled, but immiscible liquids.

The invention consists in the process hereinafter described, and in the several steps thereof, all of which will be definitely set forth in the claims.

In the drawings, Figure 1 is a diagrammatic view of an apparatus with which the process may be practiced, the several parts thereof being shown in vertical section. Fig. 2 is a plan view of one side of the separating-tank. Fig. 3 is a vertical sectional view of the same mechanism. Fig. 4 is an elevation of a part of the agitator mechanism of the separating-tank, some of said mechanism being in section; and Fig. 5 is a plan view of one of the agitator-arms and a sectional plan view of the shaft.

The process is applicable to a great variety of ores, and may be practiced in many cases so as to separate those metallic minerals which must be treated in one way from those which must be treated in some other way in order to recover their contained commercial metals, and since it is capable of being used for this purpose as well as to separate the metallic minerals from the gangue it is thought to be a great step in advance of this art.

It is believed that the process or some of the novel steps thereof may be employed with advantage in the treatment of all ores. It is obviously impossible, however, to give definite directions for attaining the best results with all ores, because of the great chemical and physical differences which they exhibit. The detailed directions hereinafter set forth are those which are found most efficient in the treatment of the Rossland, British Columbia, ores, with which I have done the most work, for the primary purpose of separating the chalcopyrite (which must be smelted) from the other constituents which may be subjected to other after treatment for the recovery of their contained metals.

The process, as an entirety, in its best form for use with Rossland ores for the purpose stated consists in the following steps:

First, in thoroughly agitating together (*a*) the pulverized ore or mineral material (*b*) enough water to make with said pulverized ore a flowing pulp, and (*c*) a solution of bitumen in a thin distillable hydrocarbon liquid as kerosene, these materials to be so thoroughly agitated together as to finely subdivide said solution into small globules and bring said globules into contact with substantially all of the pulverized mineral particles which will, by preference, adhere to them.

Second, in allowing the hydrocarbon-coated particles to float to the surface of the mass, and in rendering this separation substantially complete by gently agitating the mass, and by injecting gas into the same, and preferably also discharging into the mass fine streams of the solution. When the separation is completed, the floating hydrocarbon-coated concentrate is removed for subsequent treatment.

Third, in filtering said concentrate to free it so far as possible from the hydrocarbon liquid.

Fourth, in distilling said coated concentrate and condensing the hydrocarbon vapor to be used again.

It is thought that the use of a gas to assist in the flotation of the coated particles, as set forth in the description of the second step of the process, is radically new in this art, irrespective of its association with the other steps described. It is that which makes it possible for the first time to use thin oils and hydrocarbon. The prior processes which use thick, viscous oils will, however, be much aided by the addition of this step, because in spite of all the care which is exercised in the practice of those processes to keep the oil in large clots or masses a great deal of it is "floured" or broken up into minute particles which are trapped in the sands and lost. The employment of the gas in the manner stated brings in a more powerful floating agency than anything before used, which results in the recov-

ery of this floured oil together with numerous coated particles which would not otherwise be floated. This step of the process is therefore useful with any and all liquids lighter than water which exhibit preference of adhesion for the metallic mineral particles. Kerosene alone, for example, may be used with most ores to take out the sulfids provided the gas is used, as stated, to cause the flotation of the kerosene-coated particles. It is the bitumen, however, dissolved in the kerosene which gives the precise adhesive preference which enables it to separate the gold and chalcopyrite from the crushed ore. The bitumen may be asphalt or the bitumen produced by the distillation of petroleum to a semisolid residuum, or it may be tar, pitch, or any other specific form of bitumen. In treating Rossland ores I have found that the most satisfactory results have been attained by using a solution obtained by dissolving in kerosene about five per cent. or thereabout of Trinidad asphalt or the semisolid residuum of petroleum distillation. Preferably the pulverized ore is mixed with three to five times as much water, by weight, and to this is added a sufficient amount of the kerosene-bitumen solution, excellent results being obtained by using one-fourth to three-fourths as much, by weight, as ore. The preference of the solution for some of the mineral particles may be regulated by altering or varying the quantity of the solute substance and by varying the temperature at which the solution is used. The preference of the water for other mineral particles may be regulated by adding some acid or other chemical. A distinct advantage of using a light hydrocarbon, like kerosene, is that so much of it as cannot be removed from the concentrate by mechanical means may be recovered by a process of distillation, this method of recovery being impossible when thick non-distillable oils are used. The injection of a gas, preferably air, into the mass, which is the chief novel characteristic of the second step of the process, assists in the flotation of the hydrocarbon-coated particles. This makes it possible to finely subdivide the solution by the agitation, and this greatly increases the chance that all of the mineral particles which exhibit preferential adhesion for it shall be brought into contact with it. Some of the hydrocarbon-coated particles will float to the surface without assistance; but a considerable quantity of such particles will not be sufficiently buoyant, and some of such particles and some globules of the mixture would be trapped in the sands. In order to recover this less buoyant material together with the globules of the mixture, the mass which tends to settle is slowly lifted and turned over to liberate the coated particles and the globules, and at the same time a gas, preferably air, is blown into the mass preferably near the bottom thereof. The air-bubbles not only tend to attach themselves directly to the coated particles, and thus float them to the surface, but the air becomes dissolved in the water to its maximum capacity. This dissolved air tends to again separate itself from the water and attach itself in minute globules to the coated particles. I find that air, carbon dioxid, hydrogen, and marsh-gas are satisfactory for this purpose, and doubtless many other or all gases will operate in the same way, but I prefer air. It might be here added that because the solution is broken up into small globules there is little likelihood that any of the non-coated particles shall be entangled with the coated concentrates and carried to the surface. In removing this floating hydrocarbon-coated concentrate it is practically impossible to exclude some of the water in which the non-coated particles are held in suspension. It is therefore desirable that this concentrate shall be washed free from such non-coated minerals. This step is not, however, absolutely essential. It is possible to remove a very large part of the hydrocarbon by filtration, because of its thin character. It is not, however, possible to remove it all by this or any other mechanical process; but because of the character of the hydrocarbon solvent used it is possible to recover all of it for future use by a process of distillation which constitutes the fourth step of the complete process.

I will now describe the apparatus shown in the drawings for practically carrying on said process.

A represents the mixing-tank.

B represents the separating-tank.

C represents the settling-tank.

D represents the filter, and E another filter, which may or may not be used according to circumstances.

G represents a settling box or tank into which the liquid from the filter or filters is discharged.

H represents the retort-furnace; I, the dust-collector used in connection therewith; J, a condenser; K, the settling-tank, in which the condenser discharges the condensed vapor, and M represents a reservoir from which the solution may be fed into the mixing-tank and into the separating-tank.

In the separating-tank B is a vertical shaft *b*, having on its upper end a gear *b'*, by which it may be rotated. The head of the shaft above the driving-gear passes through an oil and air box 1, which remain stationary while the shaft revolves and is supplied by the hydrocarbon-pipe 2 and the air-pipe 3. The box rests on the rotating shoulder 4 of the shaft and is held down to a tight joint by the collar 5 and lock-nut cap 6. Through the hollow shaft 7 extends a small hydrocarbon-pipe 8, the upper end of which is firmly inserted within the upward extension 10 of the

shaft, and this central pipe conveys the hydrocarbon. In the stationary box the air enters the annular chamber 11, passing through its open bottom through a set of apertures 12 to the interior of the shaft. The hydrocarbon enters a similar annular chamber 13, from which it passes by apertures 14 into the top of the central hydrocarbon-pipe. The hub and revolving arms are shown in Figs. 4 and 5. The step-bearing is supported on a pedestal 15, provided with a wooden block 16, which supports the moving wearing-plate 17 of the shaft. Lubricating-water under pressure is introduced through the pipe 18, finding its way out from the bearing through side grooves 50. The sides 19 of the shaft are carried down below the bearing, so as to leave an annular space 20 between them and the pedestal. This annular space is intended to constitute an air-bell designed to assist the lubricating-water in excluding sand from the bearing. The air-supply in it is maintained by a slight stress of air which escapes beneath the bell through the pipe 21. The air-current for the charge passes down through the shaft, passing (as shown by the arrows) through the side channels 22 into the hollow arms 23 23. From each arm it passes out through drop-pipes 24 24. The hydrocarbon liquid is delivered through small pipes parallel with said hollow arms, emerging at the outlets 25 25. The radially-scraping blades 26 26 are secured to the arms 23 and also the inclined lifting-plow 27 at the extremity of the said arms, this being so set as to force the circulation upward at this point. The rotary movement of the charge leads the floating scum of hydrocarbon liquid, air-bubbles, and concentrates against the curved skimming-bar 28, which is hung so as to arrest and deflect this floating layer and cause it to pass into the settling and washing chamber or box 29. The edge of this box outside of the skimming-bar is submerged sufficiently to allow the floating material to pass over it, while the remaining part of said edge is raised above the liquid, so as to detain everything passing into it. Owing to the agitation within the tank caused by the movement of the arms 23 and the rising air-bubbles the water, even near the top, is not clear, but turbid or muddy, with slimes or fine particles of the non-coated minerals which do not settle rapidly enough to get out of the way. The floating concentrates are carried mainly at the lower surface of the hydrocarbon layer, where it is in contact with the water. The discharge-gate 32 in order to permit these floating particles to pass out must be set low enough to clear them, and must therefore allow a portion of the water to pass out with the skimmings, and this muddy water would therefore carry its suspended particles of the worthless minerals, which would make the concentrates impure. The settling and washing chamber or box is designed to lessen or prevent this evil. As the floating material passes over its submerged edge 29 30 it escapes from the swift current and rising air-bubbles, so that in its comparative quiet the slimes have a better opportunity to settle out of the way. The bottom of the box is divided as convenient into compartments by submerged partitions, as shown, each compartment terminating in a hopper-shape bottom with discharge-openings 33, through which the settled slimes may pass out again into the tank. Projecting shields 34 prevent the air-bubbles from entering the hoppers and disturbing their quiet. The passage of the floating material over this quiet chamber or box settles most of the slime before reaching the adjustable discharge gate or outlet 32. Before reaching the gate, however, the skimmings pass over a stream of clean wash-water introduced at the point 35 through the pipe shown. This wash-water is delivered under constant head from a supply-tank. Its quantity is made exactly equal to that passing out through the discharge-gate with the skimmings, so that this discharge, being supplied entirely by the pure water close at hand, contains little or none of the muddy water which is thus held back in the tank. It is evident that the incoming and outgoing streams are self-adjusting, because if too much enters the general level rises and a larger stream flows from the orifice.

In the mixing-tank a vertical rotating shaft *a* is mounted having, preferably, a lower bearing similar to that which is provided for shaft *b* and which has been described. Arms *a'* are attached to the shaft near its lower end, and lifting-plows are secured to the outer parts of these arms and radial plows to the other parts thereof, just as in the separator-tank. This shaft *a* is to be rotated rapidly, and the result is a thorough commingling of the various parts of the charge, which result is facilitated by the currents created in the charge by the action of said plows, the direction of said currents being indicated by the arrows in Fig. 1. This separate tank for performing the mixing operation is not necessary for my process, although it is preferable in some cases, as when a continuous discharge is desired. The mixing may be performed just as well in the separating-tank, which may then be termed the "mixing" and "separating" tank. It is merely necessary to rotate the agitating mechanism rapidly while mixing and to rotate it slowly while the separation is being made.

The material skimmed from the surface of the separating-tank may pass directly to the filter D or E; but it is best to discharge it into the settling-tank C in order to separate the

main bulk of water, and thus reduce the bulk of liquid to be put through the filtering operation. As explained, this is not essential, but is conveniently introduced prior to the filtration merely in order to separate the main bulk of water, and thus reduce the bulk of fluid to be put through the filtering operation. It is thus merely a convenience. The settling-tank C is shown as a cylindrical vessel with hopper-shape bottom, within which is suspended a cylinder 11, reaching half-way down. The stream of skimming enters this central cylinder, within which the water and hydrocarbon separate, the former sinking, while the latter, with its accompanying concentrates and air-bubbles, floats in a layer, as shown. The stirring apparatus 42 has its arms revolving gently within this layer, so as to break up and discharge air-bubbles and assist the separation. Most of the concentrates hang near the contact between the hydrocarbon and water, and as this contact-surface becomes overloaded with concentrates some of them sink to the bottom of the tank. The excess of hydrocarbon, accompanied by some of the concentrates, flows out through the launder 43, while the excess of water passing beneath the suspended internal cylinder passes out through the overflow 44, and thereby lessens the volume to be filtered. The concentrates which fall to the bottom of the tank, accompanied by the hydrocarbon which adheres to them, are drawn off in a thick condition through the pipe 45, the discharge end of which is raised to prevent the exit of more water than necessary. The two streams, one of hydrocarbon and concentrates, the other mainly of water and concentrates, may either be filtered in separate apparatus or united and put through the same apparatus, as is found most convenient. Hydrocarbon liquid and concentrates filter more easily than when water is present, and it may therefore be desirable to filter separately. It is for this reason that two filters D and E are shown, the one receiving such material as flows from the surface of the tank through launder 43 and the other that material which is discharged through pipe 45. I do not restrict myself to any particular form of filtering appliance.

The use of thin hydrocarbon liquid in place of the thick viscid oils used by other inventors makes filtration comparatively easy and permits the use of more simple and cheap methods than the centrifugal machine or filter-presses. The use of such simple apparatus is also made possible by the fact that it is not now necessary to separate the liquid very thoroughly, since its extraction is to be perfected in the distillation-retorts. I find that in some cases it is sufficient to use a simple open filter-tank with a porous bottom of any of the well-known kinds, preferably light canvas, resting on suitable supports. The liquid and water drain through the porous bottom, leaving the concentrates in the tank sufficiently drained to be shoveled into the retorts. The passage of the liquid and water through the porous bottom is aided by the well-known means of a vacuum-pump N beneath. The filter (indicated by E) is a pressure-filter barrel of well-known construction, which need not be here explained, and may be used when forced filtration is necessary. It is shown to emphasize the fact that the operation of the process is not restricted to any specific kind of filter or to any number of filters. The mixture of hydrocarbon liquid and water now free from solid matter is of course self-separating in any receptacle. A convenient form is shown in the settling-box G, into which said mixture is delivered through suitable pipes from both filters. The hydrocarbon liquid remains in one compartment *g*, from which it overflows and is returned to the reservoir. The water sinking to the bottom passes under the partition *g'* to the other compartment and flows to waste. The filtered concentrates containing some residual liquid and moisture are now ready for the distilling operation for the recovery of the five per cent or more of valuable hydrocarbon liquid remaining in them. This is done in the retort-furnace H. An iron retort 46 is set in a furnace at such an angle that the concentrates will pass down through it by gravity, but will not altogether close the upper side of the channel, which should remain more or less open for the exit and passage of the steam and hydrocarbon vapors. The retort is maintained at the distillation temperature of the hydrocarbon used, which in the case of kerosene is about 338° Fahrenheit. In order to assist in carrying off the hydrocarbon vapor, a current of superheated steam is introduced at 47, while the steam and hydrocarbon vapors pass off through the pipe at 48 to the condensing apparatus. The dry concentrates on losing their liquid and moisture slide down to the lower end of the retort, where they are drawn off through the double gates 4949, which are opened alternately, so as to prevent the escape of vapors. As concentrates are drawn off below a fresh mass is introduced above by the alternate opening of the gates 50 50, which likewise prevent the escape of vapors. An additional seal is provided by the hopper 51, which is kept filled with concentrates. The steam and hydrocarbon vapors may be led through a dust-collecting chamber I, designed to settle and collect any concentrates dust carried over, and then passes to the condenser J. This includes a metal worm or coil 53, set in a tank through which a stream of cooling-water is allowed to flow. The condensed hydrocarbon and water passing through a U-trap 54

flow into a settling-box K, similar to the one described at G. Here the hydrocarbon liquid and water separate, and the former is returned to the reservoir M for reuse, as is also the liquid recovered in the settling-tank G.

Having described my invention, I claim—

1. The process of separating minerals, which consists in mixing together pulverized mineral material, a considerable quantity of water, and a substance immiscible in water, but of less specific gravity, and which will, in the presence of water, adhere to some of the mineral particles and not to others; in violently agitating the mass so as to break up said immiscible substance into minute globules; in allowing said mass to settle whereby a considerable quantity of the mineral particles having become coated with said substance will float to the top of the mass, and in gently agitating the portion thereof which settles, and in blowing into the same a gas for the purpose of assisting the flotation of said substance and the mineral particles coated therewith; in removing the floating layer, and in separating the mineral particles from said immiscible substance, substantially as specified.

2. The process of separating ores, which consists in mixing together pulverized mineral material, a considerable quantity of water, and a solution of bitumen in a light hydrocarbon liquid, the proportion of bitumen in solution being substantially sufficient to insure the coating and entrainment of the mineral particles; in violently agitating this mixture to break up said solution into fine globules; in allowing the mass to settle, and then gently agitating the same and blowing in gas to insure the flotation of said solution and the mineral particles coated thereby; in removing the floating layer; and separating the mineral particles from the solution, substantially as specified.

3. The process of separating ores, which consists in mixing together pulverized mineral material, a considerable quantity of water, and a solution of bitumen in a light hydrocarbon liquid, the proportion of bitumen in solution being substantially sufficient to insure the coating and entrainment of the mineral particles; in violently agitating this mixture to break up said solution into fine globules; in allowing the mass to settle, and then gently agitating the same and blowing into it a gas and some of the said solution to insure the flotation of said solution and the mineral particles coated thereby; in removing the floating layer; and separating the mineral particles from the solution, substantially as specified.

4. The process of separating minerals, which consists in mixing together the pulverized mineral material a considerable quantity of water, and a solution of bitumen in a light hydrocarbon liquid; in allowing the same to settle, and removing therefrom the floating layer of said solution and the mineral particles which have been coated thereby; and in filtering the material so removed, substantially as specified.

5. The process of separating minerals, which consists in mixing together the pulverized mineral material, a considerable quantity of water, and a solution of bitumen in a light hydrocarbon liquid, the proportion of bitumen in solution being substantially sufficient to insure the coating and entrainment of the mineral particles; in gently agitating this mixture and blowing gas into the same to assist the flotation of said solution and the mineral particles which have been coated thereby; in removing said floating layer; and filtering the same, substantially as specified.

6. The process of separating minerals which consists in mixing together the pulverized mineral material, a considerable quantity of water, and a solution of bitumen in a distillable hydrocarbon liquid, the proportion of bitumen in solution being substantially sufficient to insure the coating and entrainment of the mineral particles; in allowing the same to settle, and removing therefrom the floating layer of said solution and the mineral particles which have been coated thereby; in filtering the material so removed; and in distilling the concentrate residue and condensing the hydrocarbon vapors driven off, substantially as specified.

7. The process of separating minerals, which consists in mixing together the pulverized mineral material, a considerable quantity of water, and a solution of bitumen in a distillable hydrocarbon liquid; in gently agitating this mixture and blowing gas into the same to assist in the flotation of said solution and the mineral particles which have been coated thereby; in removing the floating layer, and filtering the same; and in distilling the concentrate residue and condensing the hydrocarbon vapors driven off, substantially as specified.

8. The process of separating minerals, which consists in mixing together the pulverized mineral material, a considerable quantity of water, and a solution of bitumen and kerosene; in gently agitating this mixture, and in blowing a gas into the same to assist in the flotation of said solution and the mineral particles which have been coated thereby; and in separating said solution and mineral particles, substantially as specified.

9. The process of separating minerals, which consists in mixing together the pulverized mineral material, a considerable quantity of water, and a solution of bitumen in kerosene, and in vigorously agitating this

mixture so as to break up said solution into minute globules; in gently agitating said mixture and blowing a gas into the same to assist in the flotation of said solution and the mineral particles coated thereby; in removing the floating layer; in washing and filtering the same; and finally in distilling the concentrate residue and condensing the hydrocarbon vapors driven off, substantially as specified.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

EDMUND B. KIRBY.

Witnesses:
T. L. SAVAGE,
E. G. EASTMAN.

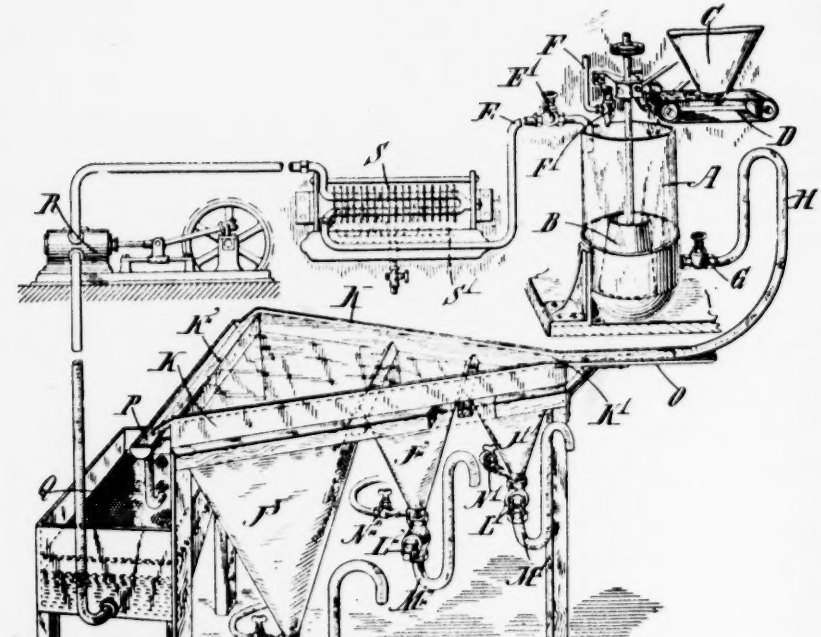
No. 835,143. PATENTED NOV. 6, 1906.

H. L. SULMAN.

ORE CONCENTRATION.

APPLICATION FILED OCT. 20, 1905.

2108



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UNITED STATES PATENT OFFICE.

HENRY LIVINGSTONE SULMAN, OF LONDON, ENGLAND.

ORE CONCENTRATION.

No. 835,143. Specification of Letters Patent. Patented Nov. 6, 1906.

Application filed October 20, 1905. Serial No. 283,704.

To all whom it may concern:

Be it known that I, HENRY LIVINGSTONE SULMAN, a subject of the King of England, residing at London, England, have invented certain new and useful Improvements in Ore Concentration, of which the following is a specification.

This invention relates to improvements in the concentration of ores, the object being to separate metalliferous matter, graphite, and the like from gangue by means of oils, fatty acids, or other substances which have a preferential affinity for metalliferous matter over gangue.

In the process described in the specification of the previous patent application, Serial No. 262,889, filed May 29, 1905, a mineral pulp is agitated with a small proportion of an oily substance, such as oleic acid or petrol or other oil, amounting to a fraction of one per cent. on the ore until the oil-coated metalliferous matter forms into a froth which can be separated from the gangue by flotation, the pulp being acidified. It is also stated that the pulp may be warmed, say, to 30° to 40° centigrade to increase the tendency for the oily substance to disseminate through the pulp and the rapidity with which the metalliferous matter becomes coated.

It is now found that if the finely-powdered ore suspended in water is mixed with a small proportion of an oily substance—say five per cent. or less of the ore—agitated and heated to a high temperature—say, to boiling-point—that is to say, to a temperature at which bubbles of steam or vapor are generated in the pulp—the formation of a froth containing the oil-coated metalliferous matter is considerably promoted, and a very efficient separation of the metalliferous matter from the gangue may thus be obtained.

The water in which the oiling is effected may be slightly acidified by adding, say, a fraction of one per cent. of sulfuric acid or other mineral acid or acid salt, or the water may be neutral or alkaline. It is to be understood that the object of using acid in the pulp according to this invention is not to bring about the generation of gas for the purpose of flotation thereby, and the proportion of acid used is insufficient to cause chemical action on the metalliferous minerals present.

The quantity of oil employed is not sufficient to cause the flotation of the metalliferous matter by the buoyancy of the oil; but the quantity may be sufficient—say five per cent. or less on the quantity of ore—to coat the metalliferous particles with a thin film of oil.

The following is an example of the application of this invention to the concentration of ore: Broken Hill or certain copper ores are finely powdered and mixed with water, acidified or not. To this is added a proportion, as above described, of an oily substance, such as oleic acid, and the mixture is agitated in a cone mixer or the like in order to effect due oiling of the mineral particles. The pulp may now be removed from the agitation (oiling) vessel and subjected to heat in suitable apparatus. As the liquor becomes heated, and especially as the boiling-point of the liquor is approached, a froth or scum rises to the surface containing practically the whole of the metalliferous matter, while the gangue remains in the pulp. The froth may be removed from the liquid by skimming or in any usual way, or the frothy portion may be separated from the remainder of the pulp by causing this to flow through a spitzkasten or the like. The froth after separation and collection may be allowed to subside, and the oily substance may be removed from the metalliferous matter by treatment with an alkali or a solvent or otherwise.

The heating of the pulp may be effected by means of closed steam-coils, or of free steam-jets, or surrounding the agitating vessels with steam-jackets, or by any other suitable means, or the treatment of the pulp by heat may be made continuous by causing it to flow over heated surfaces in a continuous stream and collecting the suitably-heated product in an apparatus wherein the separation of the froth so produced from the mineral-depleted ore-pulp can be effected; or the contents of the agitation (oiling) vessel may be heated to the necessary extent, which approaches the boiling temperature, and on cessation of agitation the mineralized froth rises to the surface.

Should any coarser particles of oiled mineral (unremoved as "froth") remain in the coarse sands of the separated pulp, these particles may be recovered by passage over a concentration or aeration apparatus or the like.

It is to be understood that the details of the process may be varied without departing from this invention.

The accompanying drawing is a perpective view of one form of apparatus suitable for

carrying this invention into practice, the arrangement being such that the contents of the agitation vessel may be heated to the necessary extent.

A mixing vessel A (of which there may be any number in series) is provided with a rotatable stirrer B. Crushed ore is fed from a hopper C into the vessel by a band D. A pipe E, controlled by a tap E', delivers circuit-water to the vessel, and oleic acid or other oil is introduced through the pipe F and tap F'. The outer cock G from the vessel A communicates, through a swan-neck pipe H, with the froth-separating apparatus.

In passing from the frothing apparatus A' to the spitzkasten (say between O and K) the pulp may, if desired, be run in a thin layer over a smooth slightly-inclined plane.

The froth-separating apparatus comprises several (say three) pointed boxes J' J^2 J^3, which open at the top into a horizontal channel consisting of side walls K. The channel has a narrow inlet K' and spreads out to a wide outlet K^2. The pointed boxes J' J^2 J^3 have full-way cocks L' L^2 L^3 at the bottom leading to swan-neck discharge-pipes M' M^2 M^3. An upcurrent of water may be led in at the bottom of each box through a tap N' N^2 N^3.

The boxes are all filled with circuit-water. The pulp from the vessel A is distributed horizontally from the flat trough O through the inlet K'. The heavy sands and coarser particles of mineral sink into the first box J', from which they are led to a shaking-table, convex buddle, or the like, to be treated as above described. The middlings or medium sands fall into the box J^2, and if they contain any mineral may be removed for further treatment by agitation. The upcurrent of water from the taps N' N^2 prevents the deposition of any slime in these boxes. The fine sands or gangue slimes settle in the last box J^3, from which they are discharged to waste or further treatment.

The slime mineral in the form of froth or scum floats from the liquid and is carried by the stream over the outlet K^2 into a launder P and thence to a filter Q, where the metalliferous matter is removed from the circuit-water, which is returned to the vessel A by a pump R. The circuit-water may be brought to the proper temperature approximately to boiling-point by passing it through a heater S, having a burner S', before admitting the water to the vessel A.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The herein-described process of concentrating ores which consists in mixing the powdered ore with water, adding a small proportion of an oily liquid having a preferential affinity for metalliferous matter, agitating the mixture, heating the mixture approximately to boiling-point until the oil-coated mineral matter forms into a froth and separating the froth from the remainder by flotation.

2. The herein-described process for concentrating ores which consists in mixing the powdered ore with water, adding a small proportion of oily liquid having a preferential affinity for metalliferous matter, agitating the mixture, heating the mixture until gaseous bubbles are generated therein so that the oil-coated mineral matter forms into a froth and separating the froth from the remainder by flotation.

3. The herein-described process of concentrating ores which consists in mixing the powdered ore with slightly-acidified water, adding a small proportion of oily matter having a preferential affinity for metalliferous matter, agitating the mixture, heating the mixture approximately to boiling-point until the oil-coated mineral matter forms into a froth and separating the froth from the remainder by flotation.

4. The herein-described process of concentrating ores which consists in finely powdering the ore, mixing it with slightly-acidified water, adding a small proportion of an oily substance having a preferential affinity for metalliferous matter in quantity insufficient to cause the flotation of the metalliferous matter by the buoyancy of the oil, agitating the mixture, heating the mixture to boiling-point until the oil-coated mineral matter forms into a froth, separating the froth from the remainder by flotation and removing the oil coating from the mineral by a solvent.

5. The herein-described process of concentrating ores which consists in finely powdering the ore, mixing it with water containing less than one per cent. of sulfuric acid, adding a proportion of less than ten per cent. of oleic acid, agitating the mixture until the oleic acid has come into sufficient contact with the mineral, heating the mixture up to boiling-point until the metalliferous matter has been raised in a froth to the surface, running the mixture over a current of water so that the froth is floated away by the current while the remaining mineral sinks, separating the froth and removing the oleic acid therefrom by a solvent.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HENRY LIVINGSTONE SULMAN.

Witnesses:
R. WILLIAMS,
T. B. BUSS.

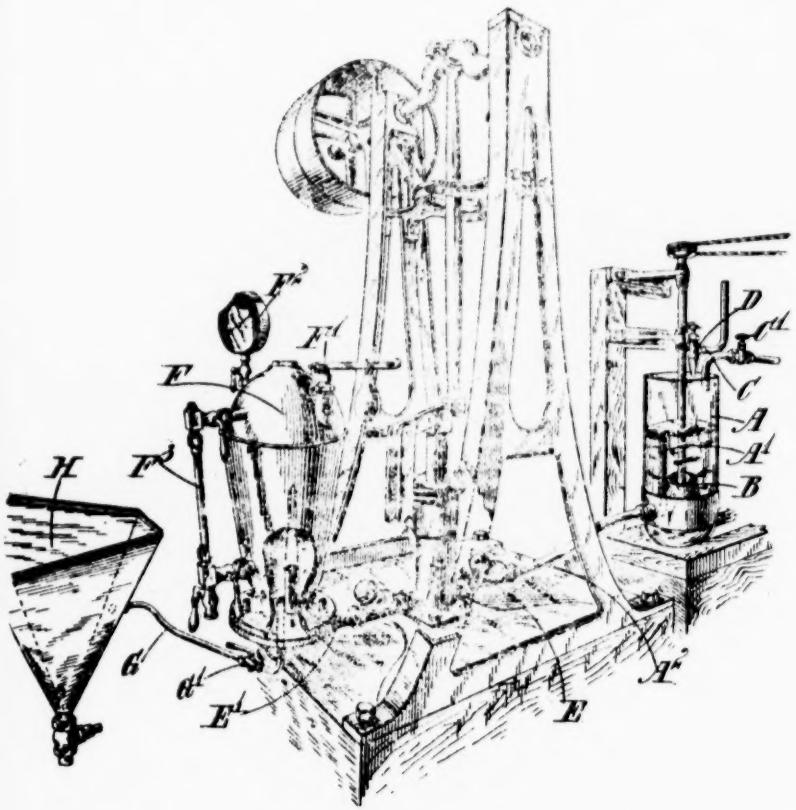
No. 835,479 PATENTED NOV. 6, 1906

H. L. SULMAN, H. F. KIRKPATRICK-PICARD & J. BALLOT.

ORE CONCENTRATION.

APPLICATION FILED JAN. 9, 1903.

2172



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UNITED STATES PATENT OFFICE.

HENRY LIVINGSTONE SULMAN, HUGH FITZALIS KIRKPATRICK-PICARD, AND JOHN BALLOT, OF LONDON, ENGLAND, ASSIGNORS TO MINERALS SEPARATION, LIMITED, OF LONDON, ENGLAND.

ORE CONCENTRATION.

No. 835,179. Specification of Letters Patent. Patented Nov. 6, 1906.

Original application filed May 29, 1905, Serial No. 262,889. Divided and this application filed January 9, 1906. Serial No. 295,328.

To all whom it may concern:

Be it known that we, HENRY LIVINGSTONE SULMAN, HUGH FITZALIS KIRKPATRICK-PICARD, and JOHN BALLOT, subjects of the King of England, residing at London, England, have invented certain new and useful Improvements in Ore Concentration, of which the following is a specification.

This invention relates to improvements in ore concentration, and this application is a division of an application filed by us on May 29, 1905, Serial No. 262,889.

Several methods are known in which air and other gas is introduced, generated, or liberated in a pulp containing powdered ore in suspension, whereupon the gaseous films or bubbles attach themselves to certain particles, which are thereby caused to float, while other particles are not so floated.

The object of this invention is to improve such processes.

The invention is particularly applicable to the separation of oiled mineral particles from unoiled particles in a pulp; but it is also applicable in some cases in which gaseous bubbles will selectively adhere to certain particles without the use of oil.

Among the previous processes depending upon gaseous flotation is that described in our previous United States patent, No. 793,808, dated July 4, 1905, in which the flotation of oiled mineral particles is brought about by the liberation of a gas in the pulp containing them.

According to this invention it is found that a convenient method of effecting the liberation or generation of gas-bubbles in such a pulp is to subject the latter to the action of compressed air or other compressed gas in a suitable vessel or apparatus from which the pressure can be subsequently relieved. If, for example, the ore-pulp after agitation with a small proportion of oil or other suitable substance having a preferential affinity for metalliferous minerals be subjected to the action of compressed air at a pressure of, say, fifty to one hundred pounds per square inch and after the lapse of a few minutes for the due solution of the compressed air or a portion of it by the pulp or the liquid be allowed to discharge itself into an open vessel at the normal atmospheric pressure, the whole of the oiled mineral will at once rise to the surface of the pulp as a coherent scum or froth, which can be removed by skimming or by a surface current of water from the gangue, which remains sunk or suspended in the remainder of the pulp. A spitzkasten is a suitable type of vessel into which the superaerated pulp may be discharged. We have found this method very efficacious in cleaning up finely-divided ore products which have been submitted to oiling. We do not confine ourselves to the use of atmospheric air, as it is obvious that any suitable gas which is soluble in water to a sufficient extent under pressure and which preferentially attaches itself to oiled mineral particles may be employed to thus effect the gaseous flotation of the oiled mineral particles. It is to be understood that we do not use pressures below the normal atmospheric pressure at the time being in any portion of the operation.

The accompanying drawing represents in perspective view one form of the apparatus suitable for carrying this invention into effect.

A mixing vessel A (of which there may be several in series) is provided with a rotatable stirrer B. Crushed ore or similar finely-divided mineral is fed into the vessel A. A pipe C, controlled by a tap C', delivers circuit water to the vessel, and in cases where oil is used the oil is introduced through the pipe D in quantity sufficient to produce a thin coating of oil on these mineral particles, for which oil has an affinity.

The pulp mixed with oil escapes over the lip of a discharge-conduit A' and passes through the pipe A^2 to a pump E. Hence the pulp is pumped through discharge-pipe E' into the closed chamber F, which is constructed to withstand a considerable internal pressure and is provided with a safety-valve F^2, the pressure-gage F^3, and a gage-glass F^4 to indicate the level of the pulp in the chamber. An outlet-pipe G, having a cock G', leads to a series of spitzkastens H, filled with circuit-water.

The operation is as follows: The cock G' is closed. Pulp is pumped into the chamber F, which contains air or other gas, and the pumping is continued until the pressure in the chamber rises to, say, fifty to one hundred pounds per square inch. The pressure is suf-

ficient to cause the air or other gas to be dissolved to a considerable extent in the pulp. After the lapse of a few minutes for the due solution of the compressed air or a portion of it by the pulp or the liquid the cock G' is opened and the pulp is discharged into the open spitzkasten H, where the liquid is of course under atmospheric pressure. The pump E may be stopped during this discharge. The whole of the mineral to which air-bubbles are attached—say the oiled mineral—at once rises to the surface as a coherent scum or froth. A surface current of water is maintained in the spitzkasten, and the floating material is thus removed and separated from the gangue, which remains sunk or suspended in the liquid.

It is to be understood that the expression "oil" includes any substance, such as oleic acid, which has a preferential affinity for certain mineral substances over others.

Having thus described our invention, what we claim, and desire to secure by Letters Patent, is—

1. The process of separating powdered minerals from one another which consists in suspending the powdered minerals in a liquid, subjecting the mixture to a gas-pressure and thereafter relieving the pressure whereby bubbles of gas are liberated in the pulp and carry certain minerals to the surface.

2. The process of separating powdered minerals from one another which consists in agitating the minerals suspended in water with a small quantity of oil, subjecting the pulp to a gas-pressure and thereafter relieving the pressure whereby bubbles of gas are liberated in the pulp and carry the oiled minerals to the surface.

3. The process of separating powdered minerals from one another which consists in agitating the minerals suspended in water with a small quantity of oil, subjecting the pulp to a gas-pressure and thereafter distributing the pulp upon the surface of a column of water whereby the unoiled particles sink while the oiled particles adhering to gaseous bubbles float and are thereby separated

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

HENRY LIVINGSTONE SULMAN.
HUGH FITZALIS KIRKPATRICK-PICARD.
JOHN BALLOT.

Witnesses:
P. WILLIAMS,
H. D JAMESON.

No. 838,626. PATENTED DEC. 18, 1906.

E. B. KIRBY.

SEPARATING TANK.

APPLICATION FILED DEC. 17, 1903.

2176 4 SHEETS—SHEET 1.

Fig. 1

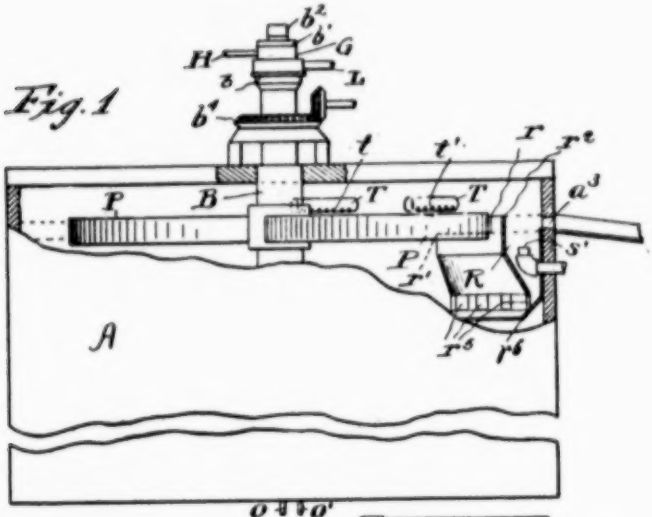
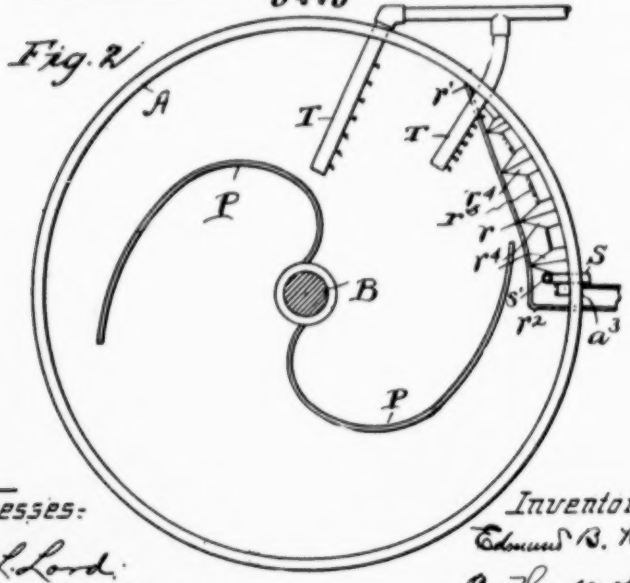


Fig. 2



Witnesses:
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Bel. Brockett.

Inventor.
Edmund B. Kirby
By Thurston & Betts,
Attorneys

No. 838,626. PATENTED DEC. 18, 1906.

E. B. KIRBY.

SEPARATING TANK.

APPLICATION FILED DEC. 17, 1903.

2 SHEETS—SHEET 2.

2177

Fig. 3

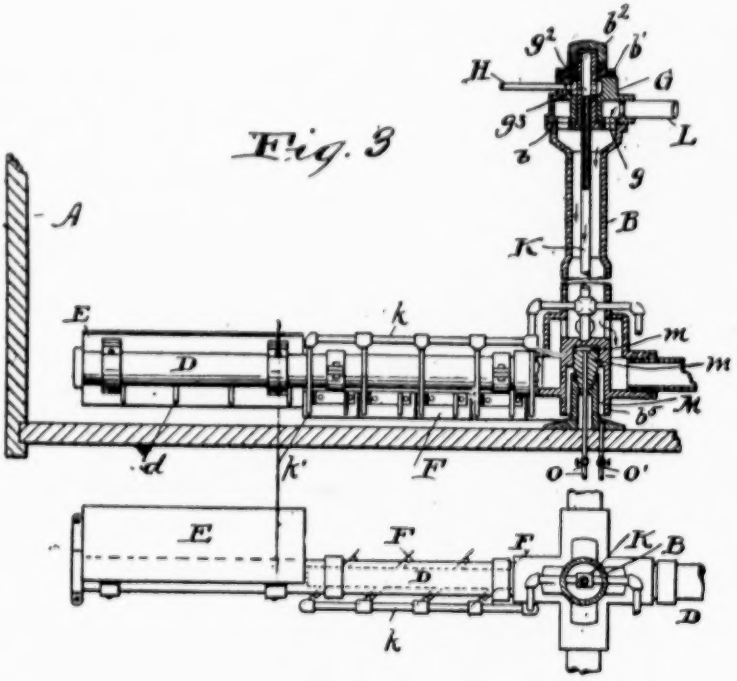

Fig. 4

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UNITED STATES PATENT OFFICE.

EDMUND B. KIRBY, OF ROSSLAND, BRITISH COLUMBIA, CANADA.

2178

SEPARATING-TANK.

No. 838,626. Specification of Letters Patent. Patented Dec. 18, 1906.

Application filed December 17, 1903. Serial No. 185,475.

To all whom it may concern:

Be it known that I, EDMUND B. KIRBY, a citizen of the United States, residing at Rossland, in the Province of British Columbia and Dominion of Canada, have invented a certain new and useful Improvement in Separating-Tanks, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

The object of this invention is to effect with substantial completeness the segregation of those pulverized mineral particles which have a preferential adhesion for water from those which have a preferential adhesion for a liquid immiscible in water—for example, oil, or a solution of bitumen in kerosene.

This invention is for the treatment of the charge after the pulverized mineral, the oil or solution, and the water have been thoroughly mixed together, whereby nearly all of the mineral particles which exhibit adhesive preference for the oil or solution have been coated therewith.

The invention is most useful when used to carry on one step of a process of my own invention, wherein the immiscible liquid employed is thin and light—as, for example, a solution of bitumen in kerosene; but the invention is also useful with oil processes for separating mineral particles.

This invention, which relates to the separator-tank and its coöperating adjuncts, may be here summarized as consisting in the construction and combinations of parts shown in the drawings and hereinafter described, as definitely set forth in the claims.

In the drawings, Figure 1 is an elevation, partly in vertical section, of an apparatus embodying my invention. Fig. 2 is a plan view thereof. Fig. 3 is a vertical sectional view of the agitator-shaft and a part of one side of the tank, and Fig. 4 is a sectional plan view of the said shaft and one of the agitator-arms secured thereto below the section-line.

The tank A is preferably cylindrical. Into it is to be charged the materials to be separated—to wit, pulverized ore, water, and some liquid lighter than water and immiscible therein, which will adhere only to the metallic mineral part of the pulverized ore—said materials having preferably been thoroughly mixed in another tank. The immiscible liquid may, as stated, be oil or a light hydrocarbon, or a solution of bitumen in a light hydrocarbon. The apparatus was especially designed for use with a charge consisting of ore, water, and solution of bitumen in kerosene, and therefore the immiscible liquid will for convenience of description be referred to herein as the "solution." The charge should be very fluid and should preferably contain three or four times as much water as mineral, some of which water may be added to the mixture after it has been transferred to the tank A.

Most of the solution and the solution-coated mineral particles rise immediately to the surface, from which they may be skimmed; but considerable quantities of the solution-coated concentrates are enveloped by and entrapped in the sands which settle to the bottom of the tank. For the primary purpose of freeing these particles from the sand and permitting them to float on the surface the vertical rotating agitator-shaft B and its adjuncts are provided. Arms D are secured to this shaft near the bottom of the tank, and as the shaft slowly rotates they gently lift the mass of sands from the bottom and overturn it and prevent it from packing, and thus permit the solution-coated particles to escape and float to the surface. These arms D are provided near their outer ends with lifting-plows E, whose front faces are set at an angle of about forty-five degrees. To these arms between the plows and the central shaft B are secured inclined scraper-blades F, which act to gradually push the material outward into the path of the plows.

It is very desirable that some gas, preferably air, shall be blown into the charge near the bottom thereof. This gas assists in agitating the charge; but its chief value is in the assistance it renders in floating the solution-coated particles to the surface. It is clear that some of these particles may be so large and heavy that the coating thereon may not be able to buoy them up, this being especially true in case the liquid used is thin and light, as the kerosene-bitumen solution. The gas-bubbles, however, not only tend to attach themselves to the solution-coated particles and to buoy them up after the fashion of balloons, but the water is caused to dissolve the gas to its maximum capacity. This dissolved gas tends to again separate from the water and attach itself in minute globules to the solution-coated particles, thus buoying them up and assisting their flotation.

It is thought that any gas which will not chemically combine with the charge may be employed in the manner and for the purpose stated; but is is definitely known that air, carbondioxid, hydrogen, and marsh-gas may be so used, air appearing to be rather the most efficient, as well as the cheapest. This gas may be injected in any way and by any means; but very efficient means for this purpose are shown in the drawings, said means consisting generally in making the shaft B and arms D hollow and providing the latter with discharge-openings and blowing the gas down through the shaft. The specific construction is as follows: The head of the shaft above the driving-gear b^4 is provided with a solution and air box G, which remains stationary while the shaft revolves and is supplied by the solution-pipe H and air-pipe L. The box rests on the rotating shoulder b of the shaft B and is held down to a tight joint by the collar b' and lock-nut cap b^2. Through the hollow shaft B extends a small solution-pipe K, the upper end of which is firmly inserted within the upward extension of the shaft and moves with and as a part of it. Air enters the annular chamber g in said box, passing through a set of apertures g' to the interior of shaft B. The solution enters a smaller annular chamber g^2, from which it passes by apertures g^3 into the top of the central pipe K. The air-current for the charge passes down through the shaft into the hollow arms D, from which it passes out through drop-pipes d. The solution is delivered from the pipe K to a series of radiating pipes k, which are secured to the arms D, and is discharged from branch pipes k'. This solution tends to attach itself to those particles not already coated, but which it will adhere to, and thus assists their flotation. The introduction of air and solution renders the separation substantially complete—that is to say, it causes substantially all of the particles which exhibit preferential adhesion for the solution to become coated thereby and floated to the surface.

The shaft B at its lower end has a stepped bearing which is supported on a pedestal M, provided with a wooden block m, which supports the moving wear-plates m' of the shaft. Lubricating-water under pressure is introduced through the pipe O and finds its way out from the bearing into the tank. The sides b^5 of the shaft are carried down below the bearing, so as to leave an annular space between them and the pedestal. This annular space is intended to constitute an air-bell designed to assist the lubricating-water in excluding sand from the bearing. The air supplied to it is maintained by a small stream of air which escapes beneath the bell through the pipe O'.

A spiral skimming-bar P, (two are shown,) which is preferably secured to the rotating shaft B, so as to extend through the floating layer of concentrates, solution, and air-bubbles, acts to direct this floating layer into the settling-chamber R and to the overflow-outlet a^3. This chamber is separated from the rest of the tank by a partition r, the upper edge of which between the points r and r' is submerged sufficiently to allow the floating layer and some of the muddy water to pass over it, while the edge of this partition between the points r and r^2 is raised above the liquid, so as to retain everything passing into it. There is an overflow-outlet a^3 from this settling-chamber through the side of the tank, which outlet is partly surrounded by the elevated part of this partition.

Owing to the agitation within the tank, caused by movement of the arms and the rising air-bubbles, the water even near the top is not clear, but turbid or muddy with slimes or fine particles of the non-coated minerals, which do not settle rapidly enough to get out of the way. The floating concentrates are carried mainly at the lower surface of the floating layer, where it is in contact with the water. The bottom of the overflow-outlet must be below the surface level of the water in order to clear them, and must therefore allow a portion of the water to pass out with the skimmings. This muddy water would therefore carry its suspended particles of the worthless minerals, which would make the concentrates impure.

The settling and washing chamber is designed to lessen or prevent this evil. As the floating material passes over its submerged edge it escapes from the swift current and rising air-bubbles, so that in its comparative quiet the slimes have a better opportunity to settle out of the way. The box is divided into compartments by submerged partitions r^4, as shown, each compartment terminating in a hopper-shaped bottom with discharge-openings r^5, through which the settled slimes may pass out again into the tank. Projecting shields r^6 prevent the air-bubbles from entering the hoppers and disturbing their quiet.

The passage of the floating material over several of these hoppers settles most of the slime before reaching the overflow-outlet. Before reaching the outlet, however, the skimmings pass over a stream of clean wash-water introduced at the point s' through the pipe S shown. This wash-water is delivered under constant head from a supply-tank. Its quantity is made equal to that passing out through the discharge-gate with the skimmings, so that this discharge, being supplied entirely by the pure water close at hand, contains little or none of the muddy water, which is thus held back in the tank. It is evident that the incoming and outgoing streams are

self-adjusting, because if too much enters the general level rises and a large stream flows from the orifice. The flow of the floating layer over the submerged partition of the settling-chamber and on to the overflow-outlet may be induced by properly-directed air-jets blown onto said floating layer from jet-openings *t* in one or more pipes T

Having described my invention, I claim—

1. The combination of a separating-tank having an overflow-outlet, and a submerged settling-chamber in said tank discharging through said outlet, with a rotatable skimming-bar supported in said tank for directing the floating layer of concentrates into said settling-chamber and toward said overflow-outlet, substantially as specified.

2. The combination of a separating-tank containing a submerged settling-chamber at one side thereof, through whose side there is an overflow-outlet from said chamber, said chamber being formed by a partition which is partly submerged, and said chamber being divided into a plurality of hopper-shaped compartments, each having a discharge-opening through its lower end, substantially as specified.

3. The combination of a separating-tank containing a submerged settling-chamber at one side thereof, through which side there is an overflow-outlet from said chamber, said chamber being formed by a partition which is partly submerged, and said chamber being divided into a plurality of hopper-shaped compartments, each having a discharge-opening through its lower end, and a shield below each of said discharge-openings, substantially as specified.

4. The combination of a separating-tank containing a submerged settling-chamber at one side thereof, said settling-chamber having an overflow-outlet through one side of the tank, and said settling-chamber being formed by a submerged partition which projects above the surface of the fluid charge around said outlet but is at other places submerged below the floating layer on the surface of said charge, with a skimming-bar which is supported in the tank and is adapted to direct said floating layer over the submerged top of said partition into the settling-chamber and toward the overflow-outlet therefrom, substantially as specified.

5. The combination of a tank having an overflow-outlet, and a vertical rotatable shaft in said tank having agitator-arms located near the bottom of the tank, with a submerged settling-chamber in said tank discharging through said overflow-outlet, the inner partition of said chamber being extended around said outlet above the surface of the liquid charge and being submerged at other points below the floating layer of concentrates, and a spiral skimming-bar secured to the shaft so as to project through said layer whereby it directs the layer of concentrates into said settling-chamber, substantially as described.

6. A separating-tank having a submerged settling-chamber at one side, and an overflow-outlet from said chamber through said side, the inner wall of said chamber being above the surface of the fluid adjacent to said outlet, but submerged at other points below the floating layer of concentrates, and a pipe discharging clean wash-water into said settling-chamber close to said outlet, substantially as specified.

7. The combination of a separating-tank containing agitator mechanism, with means for discharging into the contained fluid charge a gas and a liquid lighter than water and immiscible therewith, substantially as specified.

8. The combination of a separating-tank, a hollow shaft rotatably mounted therein having hollow connected agitator-arms which are provided with a plurality of discharge-openings, a pipe extending through said shaft, branch pipes connected with said pipe and extending toward the sides of the tank and having downwardly-directed discharge-openings, and means for forcing gas down through said shaft, and means for forcing a liquid down through said pipe, substantially as specified.

9. The combination of a separating-tank, a rotatable agitator-shaft therein having arms secured to it near the bottom of the tank, said arms having lifting-plows near their outer ends and inclined scrapers between said plows and the shaft, substantially as described.

10. The combination of a tank, with a vertical agitator-shaft therein having a bell-shaped lower end, a pedestal which is embraced by said lower end whereby the shaft is supported, and means for discharging water into said bell-shaped shaft end, and means for discharging a gas into said bell-shaped shaft end, substantially as specified.

11. The combination of a separating-tank having an overflow-outlet, agitating mechanism, a skimming-bar, and a pipe having jet-openings arranged over the surface of the charge in the tank to move the floating surface layer toward said overflow-outlet, substantially as specified.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

EDMUND B. KIRBY.

Witnesses:

T. L. SAVAGE,

E. G. EASTMAN.

No. 879,985. PATENTED FEB. 25, 1908.

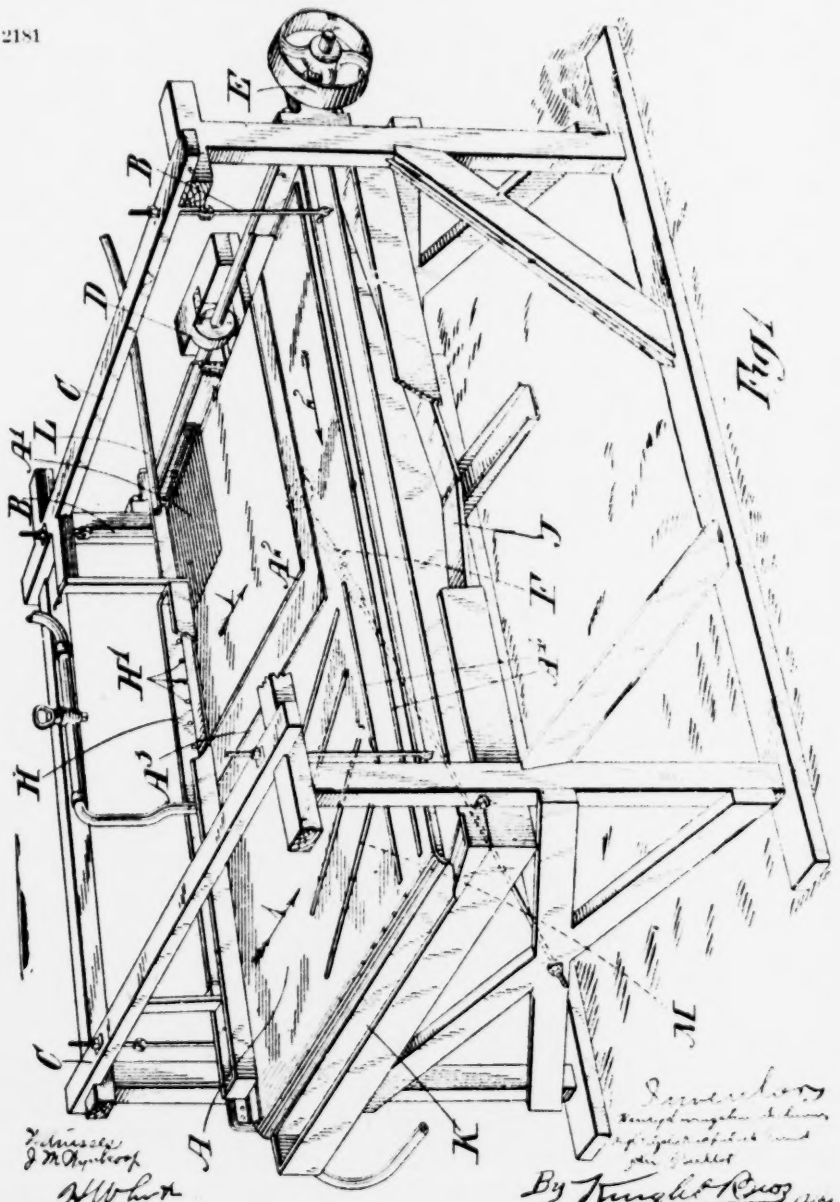
H. L. SULMAN, H. F. KIRKPATRICK-PICARD & J. BALLOT.

SEPARATION OF METALLIFEROUS MINERALS FROM GANGUE.

APPLICATION FILED FEB. 20, 1905

4 SHEETS—SHEET 1.

2181



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A. Wholt

Inventors
By Knight Bros Attys

No. 879,985. PATENTED FEB. 25, 1908

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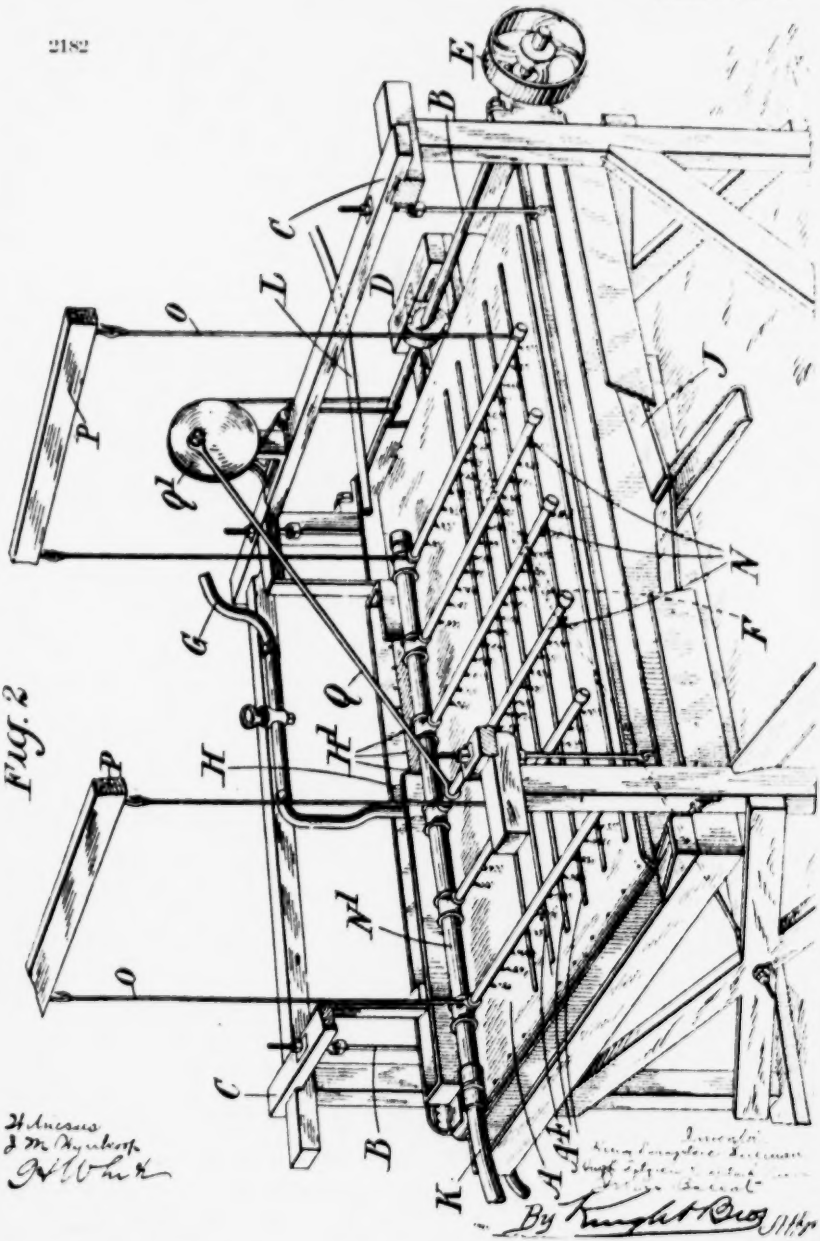
SEPARATION OF METALLIFEROUS MINERALS FROM GANGUE.

APPLICATION FILED FEB 20, 1905

4 SHEETS—SHEET 2

2182

Fig. 2



Witnesses
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R. F. Whitt

By Knight Bros Attys

No. 879,985. PATENTED FEB. 25, 1908.

H. L. SULMAN, H. F. KIRKPATRICK-PICARD & J. BALLOT.

SEPARATION OF METALLIFEROUS MINERALS FROM GANGUE.

APPLICATION FILED FEB. 20, 1906.

4 SHEETS—SHEET 3.

2183

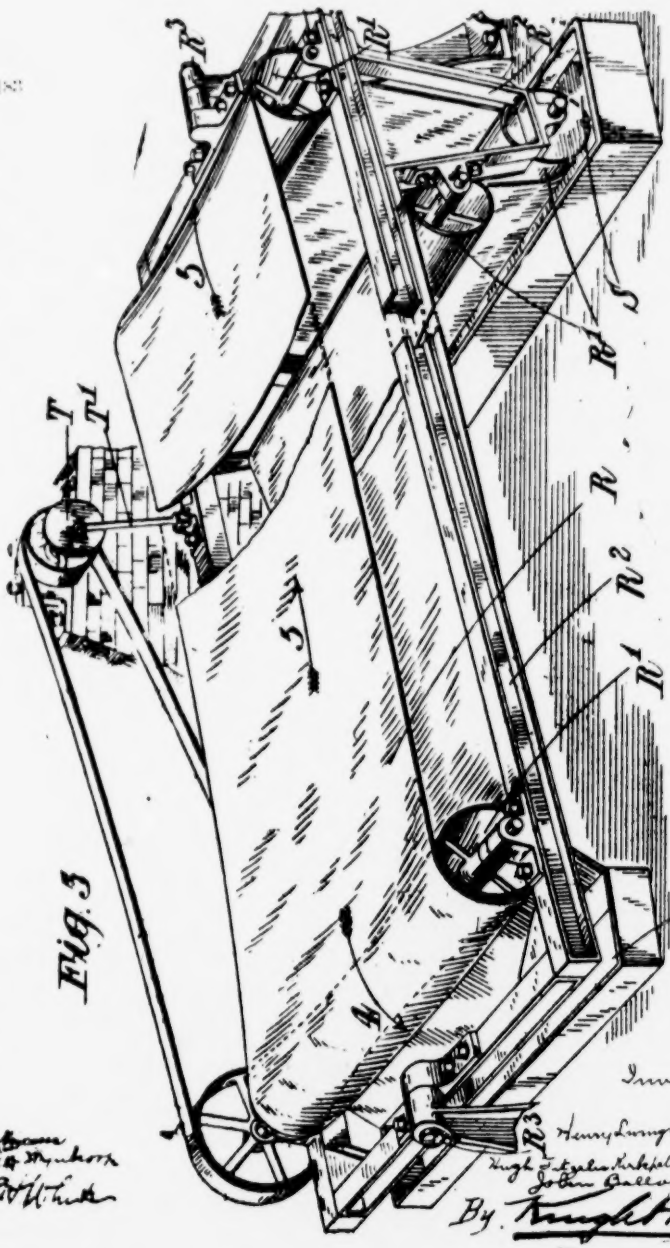

Fig. 3

Witnesses
[illegible]

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By Knight Bros
Attorneys

No. 879,985. PATENTED FEB. 25, 1908.

H. L. SULMAN, H. F. KIRKPATRICK-PICARD & J. BALLOT.

SEPARATION OF METALLIFEROUS MINERALS FROM GANGUE.

APPLICATION FILED FEB. 20, 1905.

4 SHEETS—SHEET 4.

2134

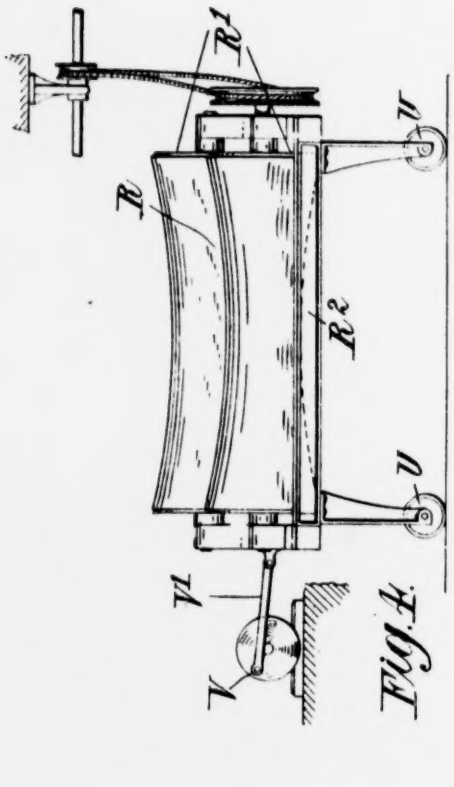

Fig. 4.

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Inventors
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Hugh Frederick Kirkpatrick-Picard
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Attys.

UNITED STATES PATENT OFFICE.

HENRY LIVINGSTONE SULMAN, HUGH FITZALIS KIRKPATRICK-PICARD, AND JOHN BALLOT, OF LONDON, ENGLAND.

SEPARATION OF METALLIFEROUS MINERALS FROM GANGUE.

No. 879,985. Specification of Letters Patent. Patented Feb. 25, 1908.

Application filed February 20, 1905. Serial No. 246,637

To all whom it may concern:

Be it known that we, HENRY LIVINGSTONE SULMAN, HUGH FITZALIS KIRKPATRICK-PICARD, and JOHN BALLOT, subjects of the King of England, and residing in London, England, have invented certain new and useful Improvements in the Separation of Metalliferous Minerals from Gangue, of which the following is a specification.

This invention relates to improvements in the separation of metalliferous matter from gangue and has for its object to effect such separation by the agency of a substance which has a preferential affinity for metalliferous matter over gangue, and by the agency of air or other gas. The substances such as oil, fatty acid, or oleaginous, fatty or tarry substances which have a tendency to wet metalliferous matter in preference to gangue will hereinafter be referred to as "oil".

According to this invention the principles of surface-tension are applied in effecting the separation. The mineral pulp is mixed with "oil" and is exposed to a free air surface; and thereafter the mineral is brought on to the surface of water or other liquid, whereby the oiled metalliferous particles, having been exposed to air, are unable to overcome the surface tension of the water and float, while the unoiled gangue sinks through the surface of the water, the former being thus separated from the latter and removed by any suitable means.

In one particular application of this invention the pulp mixed with "oil" is distributed in the form of a thin sheet on the surface of an inclined vanning table having a transverse stream of water and currents of air are directed on to the table to expose immersed mineral to a free air surface whereupon the metalliferous matter floats and is separated from the gangue which sinks.

It is known that every free water surface, *i. e.* a water surface in contact with air or other gas, exhibits a resistance to rupture from without greater than that which is offered by its interior mass. This phenomenon is known as the surface-tension of water and permits small particles of greater specific gravity than water to float upon it without rupturing its surface. All liquids exhibit surface tension phenomena to a greater or less degree, but the results are very marked where previously oiled particles are brought upon the surface of an aqueous liquid in which the oil or other fatty substance employed is insoluble or immiscible.

The resultant of the surface-tensions between the oiled particles and air and between that of the water and air, is so increased over that which exists between the air and water and air and unoiled particles, that oily particles of a much higher specific gravity in relation to water are unable to break through the water surface and therefore float with ease, quite apart from any slight diminution to their specific weight by means of adhering oil; whereas, particles of lesser specific gravity, but unoiled, readily break through the water surface, especially if these particles be previously wetted with water.

The physical phenomena above defined are according to this invention applied as follows:—The ore in which it is desired to separate metalliferous mineral from gangue is reduced to powder of a suitable degree of fineness, and mixed with water. To the mixture, oil or fatty substance, either in a free state or as an emulsion, is added and the whole thoroughly mixed; the water may have either an acid or alkaline reaction according to the nature of the ore to be treated. Oil or fatty substance exhibits the well known tendency to adhere preferentially to metalliferous mineral immersed or suspended in water, but does not attach itself to gangue or oxids. The amount of oil used may be comparatively small in relation to the ore pulp or to the mineral present. It is not employed in quantities sufficient to buoy up, by virtue of its lesser specific gravity, the mineral particles to which it attaches itself; but it is sufficient to use only such a quantity as will insure each mineral particle being thinly coated with a film of oil or fatty substance. The mass of oiled and unoiled particles is now brought in contact with air or other gas, either by removal of the mass from the aqueous liquid or by draining off the latter; and in order to insure sufficient air contact, the mass should be exposed in comparatively thin layers or sheets. If the particles be now brought upon or into contact with a fresh water surface, the previously specified surface-tension factors are brought into play, and it will be found that the oiled metalliferous particles can be floated off with ease and

completeness from the gangue or unoiled particles, the latter sinking through the water surface.

In the accompanying drawings:—Figures 1, 2 and 3 are perspective views of three different forms of apparatus suitable for carrying this invention into practical effect; and Fig. 4 is an end elevation of a modification of Fig. 3.

Referring to Fig. 1, an inclined vanning table A is supported by hangers B from a fixed framework C. An endwise jerking motion is imparted to the table in the direction of the arrows 2 by a cam D rotated by a driven pulley E, and a strong spring F acts in the opposite direction to the cam. A stream of water from a pipe G is distributed from a channel H perforated as at H^1 so as to flow across the table in the direction of the arrows 1. At the discharge side of the table is one launder J while a second launder K at the end of the table receives the longitudinal discharge. The mineral may be oiled in the manner before indicated or according to any of the known means, and the pulp mass is fed through a pipe L and through a suitable distributer, if required, on to the surface of the table A. Directly the oiled particles, having come into contact with air arrive on the water surface, they float for a sufficiently long period in the direction of the arrows 1 and thus permit of their separation and recovery in the launder or receptacle J; while the gangue sinks through the film of aqueous liquid and in consequence of the vanning motion imparted to the table works forward in the direction of the arrows 2 and is collected in the launder or receptacle K. In order to expose the pulp to the air as much as possible the surface of the table may be corrugated as at A^1 or a series of steps such as A^2 A^3 may be formed thereon. Or a series of raised surfaces M placed at a suitable angle to the forward travel of the submerged particles may be formed on the surface of the table, over which the submerged particles are forced to climb by virtue of the forward jerking motion, and by these means any oiled particle which may have escaped air contact is caused to come into such contact. If required guiding ribs A^4 may be attached, to direct the gangue to the launder K.

Referring now to Fig. 2, the vanning table is arranged as described with reference to Fig. 1 without the parts A^1, A^2, A^3, but if desired with longitudinal ribs A^4. Above the table is arranged a series of pipes N perforated on the under side, supported by wires or ties O from a framework P or the like. To the pipes N is attached a connecting rod Q reciprocated by a crank Q^1 so that the pipes are moved to and fro above the surface of the table. Air is led into the pipes N through an inlet tube N^1. Should any oiled mineral penetrate the water surface, it will be brought into contact with air again by the air jets blowing on the surface so as to rupture it and expose the immersed oiled particles to the air.

Referring to Fig. 3, the continuous inclined concave belt R passing over the rollers R^1 is driven upwards on the top side in the direction of the arrows 3; then it passes down through a trough S containing water. The rollers R^1 are carried in a frame R^2 pivoted at R^3 about the longitudinal axis and the frame is rocked about its piovts by a crank T and connecting rod T^1. Or as shown in Fig. 4 the frame may be mounted on rollers U and lateral reciprocating motion imparted to the frame by a crank V and connecting rod V^1. The pulp is fed on to the top of the moving belt and a certain proportion of oiled mineral floats, and is carried downward by the stream into the launder W in the direction of the arrow 4; while the unoiled particles sink and are carried up by the belt in the direction of the arrows 3, and discharged into the trough S. As the belt rocks or reciprocates, the liquid moves from side to side, and at each movement leaves some mineral freely exposed to the air on the side of the belt. Thus, any immersed oiled particles become exposed to a free air surface and on the return of the liquid are floated off and carried down into the launder W. The inclination of the belt must be so regulated that no sands are mechanically carried off with the concentrates.

Any apparatus suitable for the separation of floating from immersed solid particles may be used to effect the separation according to this invention. The water used to form the water surface may conveniently be slightly acid or in certain cases slightly alkaline, provided that the alkalinity is not sufficient to affect the surface-tension.

The flotation power exerted in the method above described is so considerable that aggregations of heavy oiled mineral particles may be observed floating upon the surface of the water, (more or less self-adherent) and exhibiting a concave or boat-like formation upon the surface of the water, due to the great specific gravity of the mineral particles which in consequence of their oiled surfaces are yet unable to break through the water surface.

We are aware that gases have been used previously for the separation of oiled mineral particles from unoiled particles when immersed beneath the surface of an aqueous liquid. This has been effected by the attachment of gas bubbles (preferably generated in the liquid *i. e.* in an acid condition) whereby the mineral particles are raised to the surface by means of the buoyancy of the gas bubbles adhering to the particles. It is to be clearly understood that our method of separation does not take place [illegible] the

water surface but depends solely on the flotation of previously oiled particles which have been brought into contact with air or other gas and then introduced upon the water surface.

What we claim as our invention and desire to secure by Letters Patent is:—

1. The process of treating ores to separate metalliferous matter from gangue which consists in mixing the powdered mineral with water to form a freely flowing pulp, agitating the mineral pulp with a small quantity of oil sufficient only to impart a thin coating of oil to the metalliferous particles, distributing the mixture in the form of a thin sheet of flowing liquid, causing the immersed particles to be exposed to the air and thereafter to meet the surface of the liquid, collecting the floating oiled metalliferous particles and collecting the gangue which sinks.

2. The process of treating ores to separate metalliferous matter from gangue which consists in mixing the powdered mineral with water to form a freely flowing pulp, agitating the mineral pulp with a small quantity of oil sufficient only to impart a thin coating of oil to the metalliferous particles distributing the mixture in the form of a thin sheet of flowing liquid, directing currents of air on to the liquid to expose the immersed mineral to the air, whereby the oil-coated metalliferous particles float, collecting the floating oiled metalliferous particles and collecting the gangue which sinks.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

HENRY LIVINGSTONE SULMAN.
HUGH FITZALIS KIRKPATRICK-PICARD.
JOHN BALLOT.

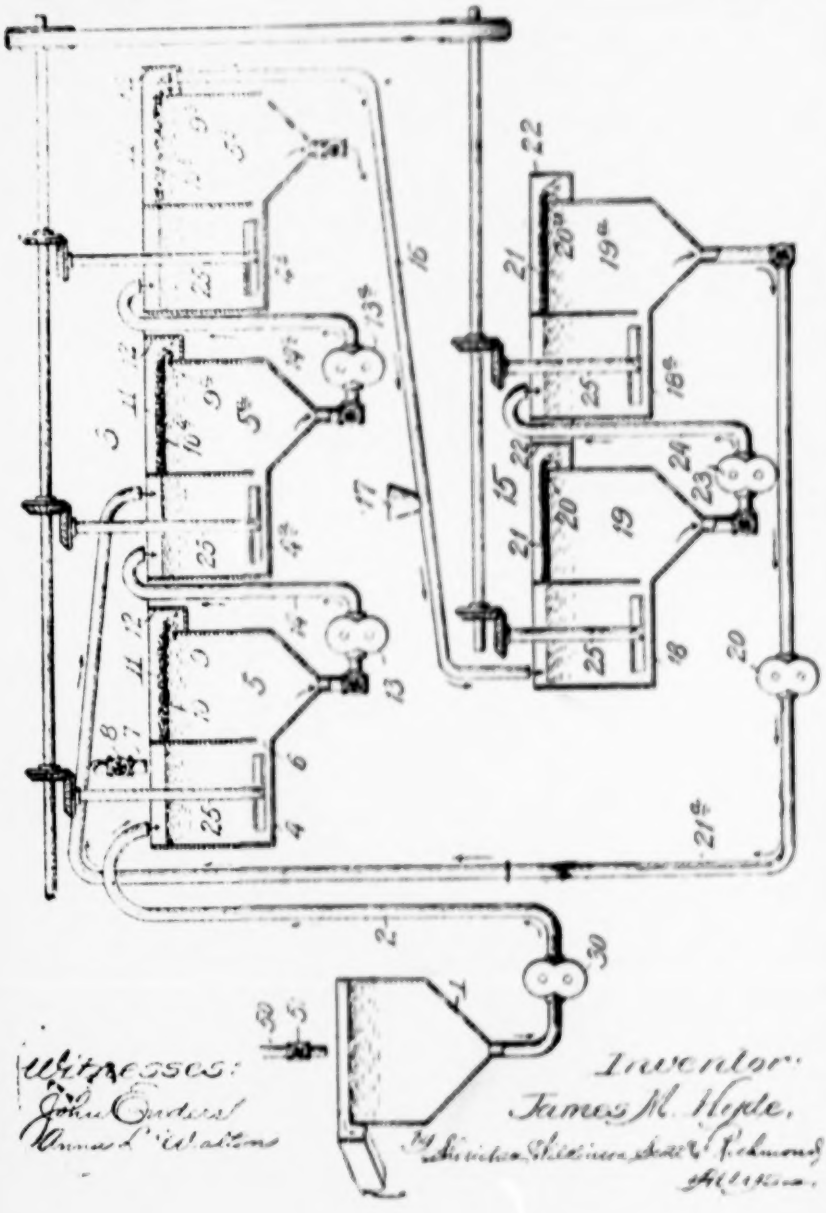
Witnesses:
WILLIAM H. BALLANTYNE,
W. W. WEBSTER.

J. M. HYDE.

2188 ART OF CONCENTRATION OF MINERAL SUBSTANCES.

APPLICATION FILED NOV. 10, 1911.

1,022,085. Patented Apr. 2, 1912.



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Thomas L. Watkins

Inventor:
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UNITED STATES PATENT OFFICE.

JAMES M. HYDE, OF BASIN, MONTANA.

ART OF CONCENTRATION OF MINERAL SUBSTANCES.

1,022,085. Specification of Letters Patent. Patented Apr. 2, 1912.

Application filed November 10, 1911. Serial No. 659,883.

To all whom it may concern:

Be it known that I, JAMES M. HYDE, a citizen of the United States, residing at Basin, in the county of Jefferson and State of Montana, have invented certain new and useful Improvements in the Art of Concentration of Mineral Substances, of which the following is a specification.

My invention relates to the separation by a flotation process of a part of the mineral substances composing an ore consisting of a plurality of mineral components.

It has heretofore been demonstrated that certain metallic and non-metallic elements, and certain natural chemical compounds of the metallic elements differ from the ordinary less valuable or valueless gangue minerals with which they occur in ore deposits, in that under certain conditions they are preferentially coated by oils, fats, oleaginous and fatty substances and derivatives thereof, and certain other organic compounds, and that when so coated they exhibit markedly different surface tension phenomena from, and can by various devices and methods be separated from, the gangue minerals, and, in certain instances at least, to a certain extent from one another.

Many ores containing a plurality of mineral components are of such a nature that when they are crushed a considerable amount of the resultant pulverized material consists of particles which are so fine and of such a colloidal nature that they settle very slowly and interfere with obtaining a high grade concentrate by the use of a flotation process. In the treatment of ores of this class I have found that their treatment is greatly facilitated, and a considerable economy is effected, by introducing a small amount of sulfuric acid with or without copperas, alum or some other such coagulant, into the pulp while in transit to the flotation device, instead of by using a larger amount of acid in the flotation device as has been done in previous practice. The acid apparently performs the following, among other functions:—the partial or complete coagulation of the slimes so that they settle much more quickly, thus making possible the thickening of the pulp in an intermittent or continuously acting pulp thickener, by the removal of a considerable amount of clear water or water containing a lessened amount of suspended solid matter, and also greatly facilitating the separation of the concentrates from the gangue in the flotation machine; the cleaning of the surface of the particles of the floatable minerals, so that they may be more readily coated by the chosen coating reagent; the generation of minute bubbles of gas in the pulp and on the surface of the floatable mineral particles, which bubbles assist in the desired separation of the mineral components of the ore; and in neutralizing any alkalinity of the ore or treatment water. The addition of the acid to the pulp before it reaches the flotation machine, rather than in the machine as has heretofore been done, affords a longer period of contact with the ore and greatly reduces the amount of acid which it is necessary to use. It precludes the necessity of having the pulp show any free acid when the flotation treatment takes place. By following this method, I have been able to get highly satisfactory results when using as little as one quarter of a pound of crude acid per ton of ore treated, whereas in previously used methods, several pounds have been found necessary.

I have further discovered that the concentrates produced, when the acid is used substantially as hereinbefore described may be retreated and raised in grade, when they contain free particles of the gangue matter, by being put through a treatment similar to that by which they were made, and that this retreatment can, in certain cases at least, be satisfactorily made without the use of additional amount of acid or coating reagent in the "cleaner machine."

Any fats or oils, fatty or oleaginous substances or derivatives thereof, and any other organic compounds which preferentially coat mineral substances may be used in this process for the coating of such mineral particles as can be made to float on the surface of water for any of the following reasons:—because of the lower specific gravity of the oily or fatty substances to which they are attached, because of their tendency to form a film on the surface of the water when properly coated, or because of their tendency to attach themselves to and be raised by bubbles of any gas which may be generated in, or introduced into the pulp.

A suitable apparatus for carrying out this process consists of launders or pipes, used in connection with or without pulp thick-

eners, and a combination of mixing boxes and spitzkastens, or overflow separating devices. Any one of a number of devices now in use, or any simple and apparent modification thereof may be made use of for this purpose.

In the drawing I have diagrammatically illustrated an apparatus whereby my process can be conveniently practiced.

Acid is added to the pulp in or prior to reaching the pulp thickener 1, which is used if the prior treatment of the ore has given rise to a pulp containing more water than is suitable for the practice of my process. The acid whether added to the pulp in the thickener or before reaching the thickener is supplied through means under the control of the operator, such as the pipe 50 leading from the acid supply, which pipe is provided with a hand valve 51. The pulp thickener may consist of any of the ordinary devices used for that purpose, such as pointed boxes having provision for overflow of the clear water. The thickened pulp is drawn off from the bottom of the thickener 1 and the waste water allowed to flow from the top thereof. The thickened pulp is conducted from the thickener 1 through the pipe or launder 2 to the flotation machine designated generally by the numeral 3, a pump 30 being used for this purpose, if necessary. The flotation machine as illustrated consists of three agitator tanks 4, 4ª and 4ᵇ, and three settlement boxes 5, 5ª and 5ᵇ. Each of the agitator tanks may, if necessary, consist of a plurality of connected compartments each provided with an agitator. The agitator tank 4 is connected near its lower end at 6 with the settlement box 5, the agitator tank 4 and settlement box 5 constituting the first unit of the flotation or separation apparatus. The other two units consist respectively of the agitator tank 4ª with its settlement box 5ª and the agitator tank 4ᵇ with its settlement box 5ᵇ. The three units are of similar construction. The pulp is first received in the agitator tank 4 and thoroughly agitated with oil from the pipe 7, which is provided with a hand valve 8 under the control of the operator. The pulp flows continuously through the machine, its rate of flow being regulated in such manner as to produce the best results. After agitation in the tank 4 the pulp passes through the passage 6 into the settlement tank 5. The sulfid particles having become coated with oil in the agitator tank 4 rise to the surface of the settlement tank 5 in the form of a froth or scum. The level of the pulp in the apparatus is so regulated by means of suitable valves that at the overflow lips 9, 9ª and 9ᵇ of the settlement boxes 5, 5ª and 5ᵇ the lower surface 10 of the froth 11 is sufficiently above the lip to insure the overflow of all of the froth 11 into the launder 12. This arrangement permits more or less water to pass over with the froth into the launder 12. The partially treated pulp, still containing more or less of the sulfids or other ore values, is drawn off from the bottom of the settlement box 5 and by means of a pump 13 is forced through the pipe 14 and discharged into the agitator tank 4ª of the second unit of the flotation machine. The apparatus is preferably so arranged that the pulp stands at the same level in the different units of the flotation device, and in the second unit of the cleaner machine which is described below, in which event the pumps are not necessary to lift the pulp but merely serve to assist in its movement. The arrangement of the apparatus may, however, be varied when necessary or desirable. In this unit the same operation takes place as in the first unit, namely, agitation in the tank 4ª, overflow of froth with more or less water from the settlement box 5ª into the launder 12 and discharge of the pulp from the bottom of the settlement box 5ª. From the bottom of the settlement box 5ª the pulp is forced by means of a pump 13ª through pipe 14ª and discharged into the agitator tank 4ᵇ of the third unit where the pulp is agitated and discharged into the settlement box 5ᵇ where the froth with some water is drawn off into the launder 12. The pulp after treatment in the third unit is discharged from the bottom of the settlement box 5ᵇ as tailings or waste, the treatment above described in the three units of the flotation machine having practically exhausted the ore of its valuable parts. In practice I have attained by the treatment described a separation running as high as 95% of the sulfids.

In conducting my process the operator constantly observes the condition of the material in the agitator tanks and on the surface of the settlement boxes 5, 5ª and 5ᵇ of the flotation machine, and likewise observes the condition of the tailings being discharged from the machine. By such observation the operator is enabled to determine whether the sulfids or other ore values are being properly separated from the gangue. The appearance of flocculent masses of sulfids in the tailings indicates the use of too large an amount of oil, while the appearance of finely divided sulfids in the tailings indicates the use of too little oil. Other indications are apparent to an operator after a little experience and by properly manipulating the valve 8 which regulates the oil supply he is able to control the operation in such manner as to secure a maximum recovery, equal, as above stated, in some cases to 95% of the entire value contained in the ore.

The launder or pipe 12 receives the sulfids, together with some water and gangue from all three units of the flotation ma-

chine 3 and these sulfids are conducted from the launder 12 to the cleaner machine which is designated generally by the numeral 15. In transit from the flotation machine to the cleaner machine the froth is conducted through a launder or pipe 16 and more water is supplied thereto, if necessary, through a pipe 17. The concentrates thus diluted are discharged into the agitator tank 18 of the cleaning apparatus and are there agitated with or without the addition of further oil, acid or other chemicals as may be desirable. From the agitator box 18 the concentrates with the water carrying them are conducted to the settlement box 19. The froth obtained in the primary or flotation machine 3 contains more or less gangue which is entrapped in the froth, and it is to purify the concentrates that I employ the secondary or cleaner machine 15. The agitation of the concentrates in the secondary machine has the effect of breaking them up to a considerable extent thereby causing the entrapped gangue to become separated from the oil coated concentrates. After agitation of the concentrates in the tank 18, as above stated, the concentrates, together with the water added thereto, are conducted to the settlement box 19, in which the gangue which has been freed from the concentrates settles to the bottom with a certain amount of the sulfids. The level of the material in the cleaning machine 15 is so regulated by means of suitable valves that the overflow lips 20 and 20^a of the settlement boxes 19 and 19^a extend slightly above the lower surface of the froth 21, the purpose being to prevent any escape of free flowing water with the froth 21 into the launder 22. As a result of this arrangement some of the froth and all of the slime carrying water will be prevented from overflowing into the launder 22 and will be carried down to the bottom of the settlement box 19. From the bottom of the settlement box 19 the water carrying with it such gangue as has been freed from the froth and also carrying such of the sulfids as have failed to flow over the lip 20 is forced by the pump 23 through the pipe 24 and discharged into the second agitator tank 18^a of the cleaning machine. The operation in the second unit of the cleaning machine is precisely the same as that described in the first unit, the overflow at the lip 20^a being adjusted as described in connection with the first unit to prevent foul water from overflowing into the launder 22. The discharge from the bottom of the settlement box 19^a will therefore contain not only such of the gangue as has been freed from the oil-coated sulfids, but will also contain a small amount of the sulfids. The discharge from the bottom of the second settlement box 19^a of the cleaner machine is therefore forced by a pump 20 or otherwise conducted through pipe 21^a and discharged into the agitator tank 4 or 4^a of the flotation machine and carried through the rest of the apparatus, together with the fresh pulp.

By the means above described, I remove a large portion of the impurities from the concentrates formed in the flotation machine, and by conducting the material drawn off from the bottom of the settlement tank 19^a of the cleaner machine and retreating the same in the primary or flotation machine I effectually guard against any loss of concentrates in the cleaning operation. The agitators 25 shown in the agitator tanks of the flotation and cleaning machines may be of any preferred form and rotated by any means available.

As an example of the way in which these improvements may be used the following description is given of the treatment of a parcel of ore by this method. The material treated was the slimy portion of an ore consisting principally of quartz, blende (the sulfid of zinc) and varying amounts of decomposed granite in which the feldspars were largely kaolinized. About 92% of this material was fine enough to pass through a 150 mesh screen. Unless a coagulant were used a portion of the slime containing a valuable amount of zinc would remain in suspension for over 24 hours. The pulp as produced contained from 20 to 100 or more parts of water by weight to one part of ore, whereas the ratio should have been from two and one half to one to four to one. To this pulp while in transit to the thickeners, was added an amount of commercial sulfuric acid equivalent to from one quarter to one half pound per ton of ore treated. At times a decided odor of hydrogen sulfid could be noticed around the pulp thickeners. The thickened pulp, usually showing no free acidity, was led to the flotation machine in which it was heated by live steam to enlarge and expand the gas bubbles generated by the acid and to facilitate the coating of the sulfid particles with the coating reagent which was added in the flotation machine. The amount of oil necessary to produce the proper result cannot be determined in advance owing to variations in the rate of flow of pulp through the apparatus, differences in the degree of dilution of the pulp, &c. differences in the amount of ore carried by the water, and variations in the composition of the ore, the ore sometimes running much higher in sulfids than at other times. There may also be other factors which have an effect upon the quantity of oil necessary to float the maximum percentage of the sulfids or other ore values. At any rate, I have found in practice that the only efficient mode of carrying out the process is to constantly observe the results produced and to vary the

supply of oil accordingly. The flotation or separation machine used in the test was of a character similar to that illustrated and described above. The pulp was thoroughly agitated to insure the coating of all of the sulfid particles with the proportionately very small amount of "candle maker's red oil" which was used as the coating agent.

After treatment in the three units of the separation machine the gangue matter as tailings was run to waste from the bottom of the settlement box of the third unit. The concentrates which had overflowed from the three settlement boxes of the primary machine were collected in the same launder and conducted to the secondary or cleaner machine, and in the cleaner machine the concentrates were treated without further addition of oil or acid. From the cleaner machine high grade concentrates were collected and rich tailings were returned to the second unit of the primary machine for retreatment. In this test run the ore fed contained 23.3% zinc, the concentrates 51.4% zinc, and the tailings 3.2% zinc, giving an indicated recovery of 91% of the zinc in the ore treated. These results were in large part due to the method of using the acid and retreating the concentrates made in the primary machine, which concentrates contained but from 38% to 42% of zinc before retreatment.

It will be understood that the apparatus diagrammatically illustrated in the drawing may be varied in form, the illustration and description of the apparatus referred to being introduced merely for the purpose of clearly setting forth the several steps of my process.

I claim:

1. The process of concentrating ore pulps comprising a separation treatment which consists in adding to the pulp a material which preferentially coats the valuable particles of the ore, agitating the mixture, permitting the valuable parts of the ore to float in the form of a froth, separating the froth by overflowing it together with some of the water in order to insure overflow of the entire mass of the froth, subjecting the separated froth to a cleaning treatment which consists in reagitating the concentrated material to free impurities entrapped therewith, permitting the concentrates to again form a froth and allowing the impurities to settle, overflowing the froth without any free flowing water, and returning the settled impurities and the part of the froth not carried into the overflow to the part of the pulp which is undergoing the separation treatment.

2. A continuous process of concentrating the valuable constituents from ore pulps comprising the addition to the pulp of an acid precipitant adapted to react upon the ore, allowing a time interval to elapse prior to subjecting it to the separation treatment, then subjecting the pulp to a separation treatment comprising the steps of adding a material which will preferentially coat the valuable particles of the ore and separating said coated particles as a concentrate by flotation.

3. A continuous process of concentrating the valuable constitutents from ore pulps comprising the addition to the pulp of an acid precipitant adapted to react upon the ore, allowing a time interval to elapse prior to subjecting it to the separation treatment then subjecting the pulp to a separation treatment comprising the steps of adding a non-metallic material which will preferentially coat the valuable particles of the ore and separating said coated particles as a concentrate.

4. A continuous process of concentrating the valuable constituents from ore pulps comprising the addition of an acid precipitant to the pulp, allowing a time interval to elapse prior to subjecting it to the separation treatment, then subjecting the pulp to a separation treatment comprising the steps of adding a material which will preferentially coat the valuable particles of the ore and separating said coated particles as a concentrate by flotation, subjecting the concentrate thus produced to a cleaning treatment which consists in agitating the concentrated material, permitting the concentrates to float, removing the concentrates from the top of the mixture, and returning the material which settles after the cleaning agitation to the part of the pulp which has passed through the first two steps specified and which is undergoing the separation treatment.

5. A continuous process of concentrating the valuable constituents from ore pulps comprising the addition of an acid precipitant to the pulp, allowing a time interval to elapse prior to subjecting it to the separation treatment, then subjecting the pulp to a separation treatment comprising the steps of adding a material which will preferentially coat the valuable particles of the ore and separating said coated particles as a concentrate, subjecting the concentrate thus produced to a cleaning treatment which consists in agitating the concentrated material, removing the concentrates from the mixture, and returning the rest of the mixture to the part of the pulp which has passed through the first two steps specified and which is undergoing the separation treatment.

6. A continuous process of thickening and concentrating ore pulps comprising the addition to the thin pulp of an acid precipitant adapted to react upon the ore and producing a thickened pulp by separating water, then subjecting the thickened pulp to a separation treatment comprising the steps of adding a

material which will preferentially coat the valuable particles of the ore, and separating said coated particles as a concentrate by flotation.

7. A continuous process of thickening and concentrating ore pulps comprising the addition of an acid precipitant to the thin pulp, producing a thickened pulp by separating water, then subjecting the thickened pulp to a separation treatment comprising the steps of adding a material which will preferentially coat the valuable particles of the ore, and separating said coated particles as a concentrate by flotation, subjecting the concentrates thus produced to a cleaning treatment which consists in agitating the concentrated material, permitting the concentrates to float, removing the concentrates from the top of the mixture, and returning the material which settles after the cleaning agitation to the part of the pulp which is undergoing the separation treatment after the thickening step.

8. The process of concentrating ore pulps comprising a separation treatment which consists in adding to the pulp a material which preferentially coats the valuable particles of the ore, agitating the mixture, permitting the valuable particles of ore to float in the form of a froth, separating the froth with some of the water in order to insure separation of the entire mass of the froth, subjecting the separated froth to a cleaning treatment which consists in reagitating the concentrated material to free impurities entrapped therewith, permitting the concentrates to again form a froth and allowing the impurities to settle, removing the froth without water, and returning the settled impurities and the part of the froth not removed to the part of the pulp which is undergoing the separation treatment.

9. The process of concentrating ore pulps comprising a separation treatment which consists in adding to the pulp a material which preferentially coats the valuable particles of the ore, agitating the mixture to bring the coating material into contact with all of the particles which can be made to float, separating the floating coated material as a concentrate with some of the water thereby insuring removal of all of the floating material, subjecting this separated material to a cleaning treatment to permit the impurities remaining therewith to settle and refloating the concentrates, removing the upper purest part of the cleaned concentrates and returning the impurities and the remaining part of the concentrates to the part of the pulp which is undergoing the initial flotation treatment prior to the cleaning operation.

10. The process of concentrating ores which consists in adding to the ore a material which preferentially coats the valuable particles of the ore, separating said coated valuable particles from the gangue by floating said coated valuable particles on water, separating the floating coated particles as a concentrate with some of the water thereby insuring removal of all of the floating valuable particles, subjecting this separated material to a cleaning treatment to permit the impurities remaining therewith to settle and refloating the concentrates, removing the upper purest part of the cleaned concentrates, and returning the impurities and the remaining part of the concentrates to the part of the ore which is undergoing the initial flotation treatment prior to the cleaning operation.

In testimony whereof, I have subscribed my name.

JAMES M. HYDE.

Witnesses:
J. BRUCE KREMER,
WALTER A. SCOTT.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

N° 12,778 A.D. 1902

Date of Application, 4th June, 1902
Complete Specification Left, 4th Mar., 1903—Accepted, 4th June, 1903

PROVISIONAL SPECIFICATION.

Communicated by ALCIDE FROMENT of Traversella, in the Kingdom of Italy, Engineer.

"Improvements relating to the Concentration of Ores"

I, HENRY HARRIS LAKE, of the Firm of Haseltine, Lake & Co., Patent Agents, 45, Southampton Buildings, in the County of Middlesex, do hereby declare the nature of this invention to be as follows:—

The following phenomena, studied by the inventor, have served as the basis of the process which forms the subject of this invention.

1. When the natural sulphides reduced to powder are moistened by a fatty substance, they have a tendency to unite in spherules and to float upon the surface of water.

2. This tendency is simply retarded by the specific weight, and opposed by the gangue which imprisons the moistened sulphides in its pulverulent mass.

3. If a gas of any kind is liberated in this mass, the bubbles of the gas become covered with an envelope of sulphides and thus rise readily to the surface of the liquid where they form a kind of metallic magma.

3. The formation of these metallic spherules is singularly active if the gas is in a nascent state.

Thus for example, if in a test tube there is placed say ten grammes of sulphuretted copper ore with its gangue, a gram of limestone, the whole reduced to powder, and if there is added thereto thirty grammes of water, a few drops of sulphuric acid and a thin layer of ordinary oil, and the mixture then agitated for a brief space, the whole of the chalcopyrite will instantly rise to the top of the liquid. The metallic spherules, pressed one against the other, will become grouped in a magma clearly separated from the rest of the liquid. If the limestone is in excess or readily attackable, the rapidity of the separation is so great that the chalcopyrite is forcibly projected outside the vessel. There is therefore a proportion to be sought for a given ore and limestone.

The small quantity of gangue mechanically conveyed gradually falls and the sulphides remain in a state of almost complete purity. Such is the principle.

Thus, the rapidity of the formation of the spherules and their ascension is in direct ratio to the quantity of gas produced in a given time.

EXAMPLE 1

A cuprous ore containing 12% of chalcopyrite, 15% of iron pyrite, 20% of carbonate of iron, 16% of dolomite and calcite and 37% of various gangues have been submitted to my said process. It should be stated that this ore could not be enriched economically by any known means.

Only a few seconds were necessary for completely separating the sulphide of copper from the rest of the gangue in which no single trace of copper could be discovered by analysis.

EXAMPLE 2

A calcitous ore having 10% of lead and unmarketable with such a proportion,

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N° 12,778.—A.D. 1902.

Lake's Improvements relating to the Concentration of Ores.

has been treated in the same manner and with the same success. There are several operations which are distinct but which are connected in carrying the process into practice; the formation of the spherules and their separation from the gangue, then separation of the product of the concentration from the oil and recovery of this latter for readmission to the cycle of operations. The products of the concentration form cakes.

Dated this 4th day of June 1902.

HASELTINE LAKE & Co
45 Southampton Buildings, London, W.C.
Agents for the Applicant

COMPLETE SPECIFICATION.

"Improvements relating to the Concentration of Ores"

I, HENRY HARRIS LAKE, of the Firm of Haseltine, Lake & Co., Patent Agents, 45, Southampton Buildings, in the County of Middlesex, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention has reference to the concentration of metalliferous ores and earths for the purpose of separating and recovering therefrom the finely divided metal or metallic compounds, and consists of a modification of what is known as the oil process of ore concentration.

The following phenomena, studied by the inventor, have served as the basis of the process which forms the subject of this invention.

1. When the natural sulphides reduced to powder are moistened by a fatty substance, they have a tendency to unite in spherules and to float upon the surface of water.

2. This tendency is simply retarded by the specific weight and opposed by the gangue which imprisons the moistened sulphides in its pulverulent mass.

3. If a gas of any kind is liberated in this mass, the bubbles of the gas become covered with an envelope of sulphides and thus rise readily to the surface of the liquid where they form a kind of metallic magma.

4. The formation of these metallic spherules is singularly active if the gas is in a nascent state.

Thus for example, if in a test tube there is placed say ten grammes of sulphuretted copper ore with its gangue, a gram of limestone, the whole reduced to powder, and if there is added thereto thirty grammes of water, a few drops of sulphuric acid and a thin layer of ordinary oil, and the mixture then agitated for a brief space, the whole of the copperpyrite will instantly rise to the top of the liquid. The metallic spherules, pressed one against the other, will become grouped in a magma clearly separated from the rest of the liquid. If the limestone is in excess, or readily attackable, the rapidity of the separation is so great that the copperpyrite is forcibly projected outside the vessel. There is therefore a proportion to be sought for a given ore and limestone.

The small quantity of gangue mechanically conveyed gradually falls and the sulphides remain in a state of almost complete purity. Such is the principle.

Thus, the rapidity of the formation of the spherules and their ascension is in direct ratio to the quantity of gas produced in a given time.

EXAMPLE 1.

A cuprous ore containing 12% of copperpyrite, 15% of iron pyrite, 20% of

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N° 12,778.- A.D. 1902.

Lake's Improvements relating to the Concentration of Ores.

carbonate of iron, 16% of dolomite and calcite and 37% of various gangues have been submitted to my said process. It should be stated that this ore could not be enriched economically by any known means.

Only a few seconds were necessary for completely separating the sulphide of copper from the rest of the gangue in which no single trace of copper could be discovered by analysis.

EXAMPLE 2.

An ore having 10% of lead and unmarketable with such a proportion, has been treated in the same manner and with the same success. There are several operations which are distinct but which are connected in carrying the process into practice; the formation of the spherules and their separation from the gangue, then separation of the product of the concentration from the oil and recovery of this latter for readmission to the cycle of operations. The products of the concentration form cakes.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, as communicated to me by my foreign correspondent, I declare that what I claim is:—

The hereindescribed process for the concentration of metalliferous ores and earths which consists in mixing the finely powdered ore or earth with water, adding a suitable oil and then liberating a gas in the mixture substantially as described and for the purpose specified.

Dated this 4th day of March 1903.

HASELTINE LAKE & Co
45 Southampton Buildings, London, W.C.
Agents for the Applicant.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1903.

2196½ United States Circuit Court of Appeals for the Ninth Circuit.

No. 3081.

BUTTE AND SUPERIOR MINING COMPANY, Designated as Butte and Superior Copper Company, Limited, a Corporation, Appellant,

vs.

MINERALS SEPARATION, LIMITED, a Corporation; MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED, a Corporation, and Minerals Separation North American, a Corporation, Appellees.

Substituted Pursuant to Order Filed March 19, 1918, for Incorrect Copy Filed November 10, 1917.

TRANSCRIPT OF RECORD.

Volume 5.

(Pages 2197 to 2868, Inclusive.)

Upon Appeal from the United States District Court for the District of Montana.

Filed Mar. 19, 1918. F. D. Monckton, Clerk.

2197 In the District Court of the United States, Ninth Circuit, District of Montana.

No. 8.

In Equity.

MINERALS SEPARATION, LIMITED, a Corporation, Plaintiff,

vs.

BUTTE & SUPERIOR MINING COMPANY, a Corporation, Defendant.

Before Hon. George M. Bourquin, Judge Presiding.

Appearances:

For the Plaintiff: Henry D. Williams, of New York; Odell W. McConnell, Esq., of Helena; L. M. Garrison, Esq.; William Houston Kenyon, Esq.

For the Defendant: Messrs. Kremer, Sanders & Kremer, Messrs. Sheridan, Wilkinson & Scott of Chicago.

2198 Be it remembered, that the above entitled cause came on regularly for hearing in the above entitled court on Monday, April 16th, 1917, at 10.00 o'clock, a. m., before the Hon. George M.

Bourquin, Judge Presiding, the plaintiff being represented by its attorneys, Henry D. Williams of New York, Odell W. McConnell of Helena, L. M. Garrison and William Houston Kenyon, both of New York, and the defendant being represented by its attorneys, Messrs. Kremer, Sanders & Kremer, and Messrs. Sheridan, Wilkinson & Scott of Chicago.

Whereupon the following proceedings were had and done, to-wit:

Mr. Williams: If your honor please, I will state to counsel for the defendant, that prior to proceeding with the trial of the suit of Minerals Separation, Limited, against the Butte & Superior Mining Company, counsel for Minerals Separation, Limited, desire to close up the suit against Hyde, which your honor will remember was argued in this court some four years ago, and has passed on to the Supreme Court of the United States, and the Supreme Court of the United States has substantially affirmed your honor's opinion, and the mandate of the Supreme Court of the United States has been returned to this court, and I believe upon the mandate of the Supreme Court of the United States an interlocutory decree has been entered according to the mandate, that interlocutory decree amending the original interlocutory decree by eliminating claims 9, 10 and 11 of the patent sued and found invalid, and containing
2199 statements pursuant to the decree and the mandate of the Supreme Court that claims 9, 10 and 11 are invalid. Now, since the mandate of the Supreme Court, which was issued on the 13th day of January of the present year, consideration has been given given to the finding of the Supreme Court that the patent in suit should be confined to the results obtained by the use of a fraction of one per cent. of oil, pursuant to the specification of the patent. The Supreme Court of the United States had before it the entire patent, and the Supreme Court stated that the patent should be so confined, and for the purpose of so confining it, adjudged that claims 9, 10, 11, which were before this court, were invalid.

In order to follow the letter and substance of the Supreme Court decision, in order to limit the patent to the results obtained by the use of a fraction of one per cent. of oil, the patentees have filed in the Patent Office a disclaimer of claims 9, 10, and 11 as drawn.

Now in the Hyde suit, the final decree which we have prepared for the purpose of terminating that suit, recites the fact that the disclaimer has been filed in the Hyde suit, (and that disclaimer is of record in this court), and the final decree further states that the plaintiffs have withdrawn claims 9, 10 and 11 from the Hyde suit; and the fact then appearing in the record in the Hyde suit that a disclaimer has been filed during the suit, the final decree will be without costs. That is the form of the final decree I have handed to defendant's counsel, and I ask that it may be settled now.
2200 The disclaimer is on file in this court; Mr. Walker has it, I believe, and it is now offered for filing. We now file this disclaimer in the Hyde suit.

Mr. Kremer: To the filing of the disclaimer we object for the reason that the disclaimer itself is not the statutory disclaimer and

does not substantially comply with the statute—the statute requiring a disclaimer in whole, and the disclaimer here presented upon its face being only a disclaimer in part; and for the further reason that the disclaimer was not filed within the time or in manner specified or provided by Section 4917 or Section 4922 of the Revised Statutes of the United States; for the particular reason that the plaintiff has been guilty of unreasonable neglect and unreasonable delay in filing the said disclaimer. In connection with this ground I might add as part of the objection that the Supreme Court of the United States, on the 11th day of December, 1916, decided the case of Minerals Separation, Limited and another, vs. James M. Hyde, and from that time until the 28th day of March, 1917, the complainant failed and neglected and negligently and unreasonably delayed in filing its disclaimer, and this, under the decisions of the Supreme Court of the United States, is not a compliance with the statute so as to take complainant out of the exception of the law, and by failing to file such disclaimer the patent becomes void, and is now void, and they cannot now have a decree entered on something that is entirely void. Under the language of the disclaimer it is a re-issue of the patent they are asking for.

2201 The Court: Does this section of the patent law cover a mere ambiguity in the specification, a specification true in some particulars, but which may be partly untrue?

Mr. Kremer: It covers that—the language of the statute is clear. I take it that counsel will agree that if we will consider that the statement of Judge Story is correct, that in the absence of these two sections, 4917 and 4922, the patent would be entirely void, and these sections were enacted solely for the purpose of giving the patentee an opportunity to avoid that which common law has enforced upon him as a penalty, an absolute invalidity, and that would apply in this case, because this disclaimer is not a disclaimer within the meaning of the statute. It is not a penalty imposed on the patentee; it is a benefit that the law extends to him which otherwise he would have been deprived of. But the statutes say to him "You can revise your standing upon the theory that you comply with the terms of this statute," which we maintain they have not done. So for that reason we object to the filing of the disclaimer, and if the decree is now offered with it, we object to the filing of the decree.

Mr. Williams: I will hand your honor also the proposed final decree. I wish first to say that as to the question of our delay, the statements that I made as to the date of the issuance of the mandate was exactly true. In the Supreme Court of the United States an opinion is given. The opinion is published for a period of 30 days;

2202 during that period it is open to counsel to make any motion that they seek for a rehearing or a reshaping of the form of the decree, and while the decree of the court is given as of the date of the opinion, (here December 11th, 1916,) and is in the possession of the clerk of the Supreme Court, it is subject to revision or alteration for a period of 30 days, and it absolutely has no force and effect until that period of 30 days has expired; then it becomes a decree of the Supreme Court of the United States, and upon it the mandate

is issued, and on January 13th, 1917, this year, the decree in the Hyde case became effective and the mandate issued; so any charge of delay against this British corporation is based upon the fact that three months ago this British corporation was informed that there was a flaw in its patent, and that as the patent existed three of its claims were not in their terms confined to what the Supreme Court said was the invention. The British patentee gave the matter careful and thoughtful consideration, and in fact the disclaimer was filed on March 6, 1917, a little more than two months after the Supreme Court of the United States had finally adjudicated the fact that the patent as it stood, in these three claims, was not confined to the results obtained by the use of a fraction of one per cent of oil.

The Court: Is this the case of a disclaimer?

Mr. Williams: Yes; the patentee in claims 9, 10 and 11 claimed more than he was entitled to.

The Court: The statute says "claims more than he discovered." That is a mere ambiguity. Is that claiming more than he is entitled to under the statute?

2203 Mr. Williams: Yes, sir.

The Court: Has the Supreme Court ever said that?

Mr. Williams: Yes, sir, the Supreme Court has said that in several opinions.

(Argument.)

The Court: In any event the court is bound to enter a decree in conformity with the mandate of the Supreme Court of the United States. What effect that will have will be hereafter debated. At this time the disclaimer is ordered filed and it will be allowed to be filed and the decree be signed in accordance with the mandate.

Mr. Kremer: Your honor will permit the noting of an exception upon the record?

The Court: Let the exception be noted.

Mr. Williams: Now, if your honor please, in the case against the Butte & Superior Mining Company——

Mr. Kremer: Before you proceed, we offer an amendment to the answer.

Mr. Williams: We object to the entry of this amendment and——

The Court: Let me hear what the proposed amendment is first.

Mr. Kremer: The amendment sets forth additional patents which the defendant claims anticipate the patent in suit and also sets up certain publications, one of the Daily Herald Democrat—one—the one of importance, the California Journal of Technology; that

2204 is the only one that was not mentioned in the prior answer filed in 1913. This was discovered after the trial of the Hyde case originally, and was a matter that was in evidence and was given consideration in the so-called Miami case. That briefly states the substance of the amendment, although the anticipating patents are enumerated there. I offered them for filing.

Mr. Williams: We object to the amendment. The objection is based upon what we shall show. The Butte Superior Mining Com-

pany was the actual party defendant in the Hyde suit. It paid all the expenses of that suit; it controlled the conduct of that suit; and in that suit, although with concealment, litigated with the plaintiff the question of the validity of this patent suit. The Butte & Superior Mining Company has therefore had its day in court, and the Butte & Superior Mining Company is bound by the adjudication in the Hyde suit, and no defense additional to what was put forward in the Hyde suit can now, at this late date, be put forward by this defendant, who has already had its day in court. Of course we have not yet brought to your honor the evidence establishing that fact. The evidence has been carefully concealed for some five years, and when it is brought to light, then we maintain that no further defense can be added in this second effort that the Butte & Superior Company is endeavoring to have litigated again, questions that have been litigated to final decision and final decree. We claim of course that these matters are res adjudicata. If we establish res adjudicata, then further defenses can not be pleaded or considered.

The Court: At this time the admissibility of this amend-
2205 ment will be held in reserve, and it will be ruled on in plenty of time to give you the benefit of it.

Mr. Williams: There is just one more point that I think perhaps I would like to state here for the record. There is no showing of diligence in the filing of this amendment. The defenses here interposed have been within the knowledge of the defendant for a substantial period of time, and the defendant has not shown the diligence which is required in presenting further defenses.

Mr. Kremer: In that connection you surely do not claim surprise after having these matters litigated in the Miami case for nine weeks; in fact you can not complain of our lack of diligence.

Mr. Garrison: That is an admission that you were in the Miami case; we are very glad to know that.

Mr. Williams: Now, if your honor please, in November, 1913, we first came before your honor in this litigation on a motion for preliminary injunction to restrain the Butte & Superior Mining Company, pending the trial of the suit. The matter was very fully considered by your honor. Affidavits were filed and testimony was taken in open court, and the various questions presented were argued, and your honor found that a case of infringement had been made out, and your honor, in lieu of an injunction, or as a means of saving the defendant from the issuance of an injunction, provided for the filing of monthly reports, and filing of a bond for $75,000, which now becomes a very insignificant fraction in view of what the monthly reports have shown. We also then presented to your honor, as well as we could with the knowledge that we then had, the question
2206 of res adjudicata, and upon the evidence that we then were able to get we did not convince your honor that the Butte & Superior Mining Company was bound by the decree in the Hyde suit; in the course of that proceeding the entire record of the Hyde suit was offered in evidence, and the defendant objected to its offer in evidence unless it should be offered for all purposes, for use at each hearing and for use at the trial, and with the same force and effect

as though all the witnesses had testified in the present suit. Thereupon the offer was thus amended and the record in the Hyde suit was put in evidence for all purposes in this suit, and is now a part of the record herein. In that record it appears that James M. Hyde, formerly an employee of the plaintiff, while in the employ of the plaintiff, was directed to go to Butte, Montana, and endeavor to bring about the adoption of the proce s of this patent by the Butte & Superior Company, which was in difficulty in the treatment of its ore; and our trusted employee, Mr. Hyde, replied by stating that his contract with us had nearly expired, and that he would go to London; and instead of going to Butte he came to London and severed his connection with the company. Shortly thereafter—he severed his connection in February or March, 1911—shortly thereafter he came to the United States—came to Butte, Montana, came to the defendant, Butte & Superior Mining Company, offered to them the knowledge that he had acquired and the training that he had received from us, notwithstanding the fact that our representative was here and requesting the Butte & Superior Company to take a license;

2207 succeeded in prevailing upon the Butte & Superior Company to make a contract with him or to permit him to install the infringing process which was installed, as he states, in August, 1911, and which has been used by the Butte & Superior Mining Company since that time with great profit to itself, in defiance of the patent. In that suit it appeared that when this defendant, James M. Hyde, was asked who was paying the expense of the other suit, he put forward that beautiful explanation—I am paying the expense of this suit with the proceeds of the sale to the Butte & Superior Company of an exclusive license in the Butte district under my patent—which was issued some time after the suit was commenced. The great expense of that litigation, a wholly uncertain quantity, according to Hyde, was to be paid out—not by the company—but by him. That was the consideration for the transfer to the company of this extremely restricted interest in a certain patent that James M. Hyde claimed to have. We proved in that case that this patent was a sham and a fraud; that it was founded on two things, one of which he had learned while in our employ, and the other was a known fact before. It was a perfectly worthless patent. The evidence shows it.

We shall prove, if it is possible to do so—if it is possible to bring out from concealment the real facts of the relations of James M. Hyde with the Butte & Superior Company—that the first installation, which Hyde in that suit admitted was his—was in fact erected with the funds of the Butte & Superior Company at the plant of the Butte &

2208 Superior Company, operated by the Butte & Superior Company, and that Hyde was a mere salaried employe of the Butte & Superior Company, with possibly some contingent interest coming to him in the event of success. We do not know all the facts which we shall try to bring out.

Now, the questions at issue have been litigated—litigated to the end. The Supreme Court of the United States has spoken. There is just one new point of law in this case. There can be no new defenses, because that litigation is over. There can be no attack upon

the validity of the patent, because that has been adjudged. But there is the new point of law, and that is the point of law which arises as to the disclaimer. Before the Supreme Court of the United States, claims 9, 10 and 11 as they existed in the patent, included within their scope too much. There was not a word in that specification from beginning to end up to the claims that was in the slightest degree objectionable or capable of criticism. The disclosure of the invention was complete and claims 1 to 8 and 12 were claims which were each one limited within the scope of that invention, but in these claims 9, 10 and 11 the patentees had not put the definite limitations to the invention that they disclosed and claimed in the other claims, and so the Supreme Court held that these three claims were in doubt; the patent must be restricted, and the plaintiff, giving the matter the mature thought and consideration, decided that under the law the proper way to restrict it and to be within the letter and substance of the Supreme Court decision was to file a formal disclaimer.

which has been filed; and of course that is a new question of
2209 law remaining for adjudication in this case, apparently raising only the question as to whether or not the limitation that has been imposed upon the scope of those claims by that disclaimer has now validated those claims within those limitations.

The Court: Is it a case where a disclaimer is necessary? The court will take the liberty of doubting it until I hear you further—as limited by your disclaimer are they in addition to your other claims?

Mr. Williams: We think they were not exactly proper, and that is why we filed the disclaimer. It was a question for serious consideration. It seemed to us that a claim which said that you put in ore pulp an amount of oil which is a fraction of one per cent, might not—although it could be by the doctrine of equivalents—might not possibly be construed as applying to a condition of things wherein the defendants did put into the ore pulp an amount of material which might be called an oil, in a proportion that was slightly greater than a fraction of one per cent, and they might obtain the results which for the first time were obtained by the process of the patent in suit; and it seemed to us that we would be in a better position in maintaining our rights to the invention which the Supreme Court gave us, if we validated those claims, by limiting their scope so as not to have the mathematical foot rule definition, but that definition which the Supreme Court expressed, "the results obtained by the use of oil amounting to a fraction of one per cent on the ore," and that is why we did it that way.

I may say that we also felt convinced that had we filed a disclaimer
on these claims in toto, the defendant would come to this
2210 court and say—Why, those plaintiffs, by their affirmative act, have disclaimed any process wherein there is put into the ore pulp any quantity of oil exceeding a fraction of one per cent; they have done it affirmatively and they can not by any possibility—ask for the application of the doctrine of equivalents—the remaining claims must be limited to the measurements expressed by them—those are the considerations that led us to take this step; so that we

come to this court with claims 9, 10 and 11 validated by the disclaimer of that part of their scope wherein the Supreme Court said they were broader than that to which they should be confined.

Now, if your honor please, this proceeding—this trial—is upon the pleadings, and for the purpose of this trial and for the purpose of the interlocutory decree, which is the only decree which can follow this trial should the decree be for the plaintiff—we have only to prove, and we shall submit to the court as the only consideration that is pertinent, that after the issuance of this patent, during the existence of this patent and before the commencement of this suit, the defendant performed an act of infringement. Having proved that the defendant in that period performed an act of infringement, we have established our right to the interlocutory decree, which directs the injunction and which directs the accounting, which within your honor's discretion may be referred to a master in whole or in part,
a matter that will be considered when we get to that part of
2211 the trial.

Now, for the purpose of the issues here involved, or the interlocutory decree which we ask at this trial, we have a remarkably simple state of facts. The plaintiff claims res adjudicata, and will try to prove it. The plaintiff claims that that act of infringement was performed, and—although it will be finished by stipulation, of which the exact terms have not been agreed upon because Mr. Scott and I have not had time to get together this morning, but it is understood—and we also have depositions that were taken.

The Court: The stipulation covering the infringement?

Mr. Williams: Covering the acts of which we complain.

Mr. Kremer: As to the amount of oil.

The Court: I see.

Mr. Williams: In addition thereto we took some testimony, which was by depositions, nearly three years ago, based upon examination and assay of a specimen of the concentrates of the Butte & Superior Mining Company, which were obtained from a car at Oklahoma, and the stipulation will identify those concentrates as concentrates obtained by the defendant at its flotation plant; the evidence already taken by deposition will be filed, and from our view point—there is of course the question of law as to whether or not those acts of the defendant are acts of infringement, and as to that, of course, the Hyde decision will control; that seems to the plaintiff as the whole case that is before this court, up to the point of the interlocutory decree.

Now, that completes my opening, and I presume it is unnecessary
to note that the record in the Hyde case is offered in evidence,
2212 but if it be necessary it is noted here that the entire record
in the Hyde suit is offered in evidence.

Mr. Kremer: The record in this court?

Mr. Williams: Yes; that being of record in this court. Then the mandate, the decree and mandate of the Supreme Court of the United States in the Hyde case are also offered in evidence. It so happens that those documents are in Helena this morning, but the defendant is fully advised as to them. The mandate itself and a

copy of the decree of the Supreme Court annexed to the mandate, happen to be in Helena this morning. They are offered in evidence, however.

Mr. Kremer: We have no objection; they may be offered at this time.

Mr. Williams: The disclaimer of March 28, 1917, is offered in evidence by a certified copy thereof.

Mr. Kremer: To which also we object for the reason that the purported disclaimer is no disclaimer in point of law, for the reason that the disclaimer, in its very language, discloses the fact that the complainant disclaims nothing; that there is no relinquishment of any purported right to claims 9, 10 and 11 embodied in said disclaimer; that the only attempted relinquishment of said claims is covered by the statement as follows: "Excepting where the results obtained are the results obtained by the use of oil in a quantity amounting to a fraction of one per cent on the ore," by such exception the plaintiff nullifying all previous attempts at disclaimer, making the disclaimer mean nothing and not yielding to the decision of the Supreme Court of the United States that said claims were invalid in toto.

2213 For the further reason that the said disclaimer was not filed until the 28th day of March, 1917, and the decision of the Supreme Court in the Hyde case, holding claims 9, 10 and 11 of the patent invalid, was rendered on the 11th day of December, 1916, and, under the statement of counsel here made in court, the date just mentioned is correct; and the mandate upon which he seeks to avoid unreasonable delay was issued on the 13th day of January, 1917, 74 days before the filing of the disclaimer.

For the further reason that, taking the notice and not the process of the court, which was chargeable to the complainant, therefore the date would be as of December 11th, 1917, and, by reason of the foregoing the complainant has been guilty of an unreasonable neglect and delay in the filing of the said disclaimer within the meaning of Sections 4917 and 4922 of the Revised Statutes of the United States.

For the additional reason that it is the law of the land, the decision of the Supreme Court of the United States, that said disclaimer must be filed immediately upon the rendition of the decision by the highest court in the land, that being the highest court in the land.

Now, if your honor pleases, we are prepared to argue this case, if your honor desires to hear argument upon it at this time. Shall we proceed?

The Court: Yes.

Mr. Kremer: At the outset, if your honor pleases, without indulging to a protracted degree into the history of patent law,

2214 it would be well to observe that the statutes protect the right of the patentee.

I suppose you take the position that the patent in suit was offered in the Hyde case, and it is therefore in this case.

Mr. Williams: Yes.

Mr. Kremer: That is the position I take.

As I started to observe, the statutes perfecting the rights of the

patentee are very few, and the law with reference to his rights and the limitations upon his rights is exceedingly simple, as is ofttimes observed in a discussion of the historical facts surrounding the law of patents.

The right to a patent had its origin in the giving of grants to favored courtiers, to the bestowal of exclusive rights to certain favorite courtiers, and in that manner the question of monopoly first received attention, followed by ultimate resentment from the people who were oppressed by the king's prerogative of granting to one man that which no other man should enjoy. That was the origin of patents. The holder of the monopoly at that time occupied no other position than the holder of a patent today, shorn of the restrictions which the law places about monopolies and patent rights. This condition became so distasteful that it resulted in the enactment by parliament of the Act of Monopolies, which I believe was in 1623. This was followed by judicial interpretation. One exception alone was made to the Act of Monopolies and that was where one had invented or had from his own brain conceived that
2215 which was a benefit to the nation, he, to a limited extent, should enjoy the fruits of his own ingenuity. And it was upon that that the patent law of today was based. In this country the rights of patentees rest almost exclusively upon the power granted by the Constitution to Congress and the enactments of Congress.

Now, it is hardly necessary for me to observe that judicial interpretation instead of being of a liberal scope, as has been indicated by counsel in his opening statement, has been zealous of these public rights. It has restricted the rights of the patentee, and only recently, within the week, the Supreme Court of the United States has thrown additional restrictions about the so-called rights of patentees and has announced the rule that, "Thus far shalt thou go, and no farther," because you enjoy that under the guise of law to which you would have no natural or just rights if it were not for the operation of the law. Now, with this in mind, let us approach directly the question before the court.

If it were not for the enactment of Section 4917 and Section 4922 of the Revised Statutes of the United States, the patent in suit, or any part of the claims of which had been held invalid, would be void, and of no force or effect. I take it there can be no dispute and will be no dispute between counsel in this case as to that being the rule of law. The reason for that is based upon that which counsel perfectly expressed in the pleadings of this case, insofar as it
2216 applies to the common law defense. And this portion of the answer rests on a paragraph, the rule of the common law as to the validity of the patent contained in paragraph 3 upon page 18 of the original answer: "This defendant avers that for the purpose of deceiving the public the description and specifications filed by the said patentees in the Patent Office was in some particulars made to contain more than the whole truth relative to their alleged invention or discovery and more than is necessary to produce the desired effects, and that in other particulars the said description and specifi-

cation was made to contain less than the whole truth relative to their alleged invention, and discovery." And, upon that state of facts, at common law, a patent was held to be invalid in toto. If there was one invalid claim the patent failed by reason of the defect in structure. Why? It was a safeguard to the rights of the public, because if that were not true—and I am attempting at this particular time to address my remarks somewhat to the inquiry propounded by your honor to counsel when we were discussing the entering of the decree in the Hyde case—because if that were not true and there were 18 claims in a patent and 17 of them were invalid and only one valid, the claimant could then go on and hold himself out to the public under the guise of having a patent issued in his name, under the guise of a claim of right, and thereby deceive the public and prevent the public from the ultimate enjoyment of something that might be of great public weal. It is to safeguard the public that this rule of law exists. Therefore the same rule exists with reference to
2217 the statement of 18 claims where there is one invalid claim as exists as to the statement of 18 claims where there are 17 invalid claims. There is no distinction.

Now, I take for granted that counsel will admit, and if they do not, then the question can be speedily and readily disproved by the slightest examination of the authorities, that in the absence of these two remedial statutes this patent in suit would be entirely void. I use the words "remedial statute" because counsel has declared to the court in his very able explanation of the patent law, that these are remedial statutes and thoroughly remedial statutes.

Now that brings us to this question: First, is it necessary for the complainant in this case to comply with these sections of the Revised Statutes of the United States in order to save its patent from entire invalidity? Second, is the disclaimer here on file in law a disclaimer?

I shall take up the first question and at the outset I desire to call the court's attention, although it does not appear as the first case cited in the brief which I hold in my hand, the case which I believe can well be considered the leading case upon this subject, the case of O'Reilly vs. Morse, 15 How. 62, 14 Law Ed. 609. And before discussing that question I desire to refer to the statement made by counsel in his opening argument that some of the courts have held that six months is not too long, six months is not an unreasonable delay under certain conditions. I challenge counsel to show that such a condition ever existed whereby the court gave it that
2218 consideration where there had been a decision by the Supreme Court of the United States. Your honor will find upon an examination of the authorities that the courts have held that four weeks, two weeks, ten days or 45 days—I think that is the maximum I have seen—is not an unreasonable delay because the invalidity of the patent or the invalidity of the claim of the patent had not been adjudged by the highest court in the land. The converse of that reasoning then must be that if the highest court in the land had decreed the invalidity of the claim of this patent then that length of time would have been an unreasonable delay. There can be no answer to that logic. Therefore we are then confronted with this situation:

that if the highest court in the land has decreed the patent invalid then this is the final word, and it is incumbent upon a claimant to no longer deceive the public by holding himself out to the world as the owner of a claim that the Supreme Court has said he does not possess. Therefore, I take it, and I believe, that he must move expeditiously, because with that decision his rights terminated and any act of his subsequent to that time is an infringement upon the rights of the public and a direct violation of the law of the decision, in view of the fact that he is encroaching upon the limitations of the monopoly.

Now, referring to the case of O'Reilly vs. Morse, the court said in part: "The law which requires and permits him to disclaim is not penal, but remedial." The law which permits him to disclaim is remedial. "It is intended for the protection of the patentee, as well as the public, and ought not therefore to receive a
2219 construction that would restrict its operations within narrower limits than its words fairly import. It provides, 'when any patentee shall have in his specification claimed to be the first and original inventor and discoverer of any material, or substantial part of the thing patented, of which he was not the first and original inventor, and shall have no legal or just claim to the same,' he must disclaim in order to protect so much of the claim as is legally patented." I think, if your honor please, that that paragraph answers very completely the inquiry that you propounded to opposing counsel this morning. "'Whether, therefore, the patent is illegal in part because he claims more than he has sufficiently described, or more than he invented, he must in either case disclaim, in order to save the portion to which he is entitled, and he is allowed to do so when the error was committed by mistake.'

"'A different construction would be unjust to the public, as well as to the patentee, and defeat the manifest object of the law, and produce the very evil against which it intended to guard.

"'It appears that no disclaimer has yet been entered, at the patent office; but the delay in entering it is not unreasonable, or the objectionable claim was sanctioned by the head of the office, it has been lation are found to exist among the justices of this court. Under such circumstances the patentee had a right to insist upon it, and not disclaim it until the highest court to which it could be carried
2220 had pronounced its judgment." And that has been done in this case; has been long since.

"'The omission to disclaim, therefore, does not render the patent altogether void, and he is entitled to proceed in this suit for an infringement of that part of his invention which is legally claimed and described. But, as no disclaimer was entered in the patent office before this suit was instituted, he cannot, under the Act of Congress, be allowed costs against the wrongdoers, although the infringement should be proved.'"

Therefore that decision in the O'Reilly case holds that when the highest court of the land had pronounced invalid the claim of a patent the disclaimer must be filed without unreasonable delay; and that unreasonable delay certainly falls within a limitation no less than the time in the suit at bar.

Again, your honor, referring to the question of claims in the case of Seymour v. McCormick, 60 U. S. page 96; 15 Law Ed. 557, the Supreme Court in discussing the rule said "It is said by the learned counsel of the defendant, that there is a claim in the patent outside of the two claims that are in controversy, which is void, because McCormick appears, from the evidence, not to have been the original and first inventor and that inasmuch as he had made one void claim his patent is void, as it respects all the other claims. Although the evidence may show that he was the original and first inventor of all these other claims, as regards the law applicable to this point, the learned counsel is not strictly correct. The law is this:
2221 if a patentee makes a claim which is not well founded in the same patent with other claims which are well founded, he may disclaim, within a reasonable time that which he had no right to claim, and then his patent will be good as to the residue—as good as if it had originally issued only for claims which are valid. If he omits to make a disclaimer, but brings a suit for the violation of his patent, and it satisfactorily appears upon the trial that he is entitled to be protected in a portion of the claim set up in his patent, but that he is not entitled to be protected in respect to another portion, he is still entitled to damages for a violation of the valid portion of his claim, the same as if all the claims were valid, so far as regards the mere right of recovery, but he gets no cost. That is the law. It has this qualification: if the jury are satisfied that there has been unreasonable negligence and delay on the part of the patentee, in making a disclaimer as respects the invalid part of his patent, then the whole patent is inoperative, and the verdict must be for the defendant, as in this case the claim on which the question arises is as follows: * * *" And it goes on. That was a case for damages, tried before a jury and this was said in discussing an instruction given to the jury, but of necessity that same principle applies in actions at law as maintains in a suit in equity. The O'Reilly-Morse case is cited to the same effect, and Silsby v. Foote, 61 U. S. 377-378.

I will say to the court in passing that I have found no rule contrary to these decisions to which I have just referred; I have
2222 endeavored to select what I consider the best considered and so-called leading cases upon this subject, trying to use the Supreme Court of the United States decisions in all instances, and I believe I have done so in all save one, the case to which I will refer in closing. In the case of Silsby v. Foote, and I desire to call your honor's attention to the strong dissenting opinion of Mr. Justice Grier, in which dissenting opinion Justice Grier discussed this question of disclaimer.

It has been suggested by Mr. Sheridan that the majority decision as well as the dissenting opinion agree upon the facts in the case, and that there exists only a difference of opinion in connection with the limitation that should be placed upon the time of filing of the disclaimer. I direct your honor's attention to that case. It is not at all opposed to any case here cited, but, on the contrary, very strongly

upholds the uniformity of the decision of the Supreme Court of the United States on this question.

Smith v. Nichols, 88 U. S. 112, 22 Law Ed. 566 is another case dealing substantially with the same question.

In a very recent case the court in speaking of the matter of disclaimer, spoke as follows:—this was a case in which one of the distinguished gentlemen appearing upon the other side appeared—Motion Picture Patents Co. vs. Laemelle and others, 214 Fed. 796. I think Mr. Kenyon was of counsel in that case. The court in the discussion of this question of disclaimer says, "It was quite natural
that the valuable additional rights thus conferred by the dis-
2223 claimer act sections should be surrounded with substantial
safeguards, and the Congress determined that the patentee should not eat his cake and have it too." A very homely way of expressing it, but at the same time a very forcible way. "Therefore, it was provided among other things, that no patentee should be 'entitled to the benefits of this section' if he 'unreasonably neglected or delayed' to enter a disclaimer. 'The benefit of this section' undoubtedly means the right to 'maintain a suit at law or in equity for the infringement of any part thereof.' (Meaning 'the thing patented') 'which was bona fide his own.'

"There has been a good deal of discussion as to what would constitute unreasonable neglect or delay so as to deprive a patentee of the benefits of the disclaimer section, and, when appeals in patent cases went direct to the Supreme Court, it was held that the delay until the Supreme Court had finally passed on the validity of the claim was not unreasonable. O'Reilly v. Morse, 15 How. 62, 120; Seymour v. McCormick; Gage v. Herring" cited by the court.

"It is urged by counsel for complainant that since the creation of the Circuit Courts of Appeals by the so-called Evarts Act, a delay to disclaim cannot be held unreasonable until the patentee has first exhausted every effort to reach the Supreme Court of the United States. Such efforts have not infrequently involved the litigating of the validity of a patent, in even more than two Circuits, as was instanced in the Grant Tire Case, which was held invalid by the
Court of Appeals for the Sixth Circuit, 116 Fed. 363, and
2224 again by the Court of Appeals for the Seventh Circuit, and
later came before the Court of Appeals for the Second Circuit, which held the patent valid. (Consolidated Rubber Tire Company vs. Firestone Tire & Rubber Company, 151 Fed. 237, 80 C. C. A. 589), and finally reached the Supreme Court by certiorari, where the decision sustaining the patent was affirmed (Diamond Rubber Company v. Consol. Tire Company, 220 U. S. 428"—)citing a number of cases. As I said, this case is reported in 214 Fed. That is perhaps the latest decision of any court on this very important question of disclaimer, and in this opinion the district judge, I believe, has embraced the better considered decisions, showing the uniformity of law in connection with this matter of disclaimer.

So, if your honor please, without prolonging this discussion by the citation of additional authorities, which would no more than bear out the statement of the law as embraced particularly in the O'Reilly-

Morse decision, as well as the Silsby-Foote decision and the Seymour-McCormick case, I believe that we can rest upon the statements that we made in the beginning, it being borne out by the decisions that in order to save their patent from complete annihilation, so to speak, it is incumbent upon them to disclaim these claims that the Supreme Court held to be invalid and that by failing to disclaim they have imposed upon the public to the extent of holding themselves out as the owners of a monopoly upon a process embraced within these claims 9, 10, and 11, when they in fact do not own it.

Now, that brings me to the disclaimer itself. As has been
2225 called to your honor's attention, they say, "We disclaim 9, 10, and 11, but we want to keep this much of it." If these claims are invalid, as the Supreme Court has said they are invalid in toto, there is no part of it that you can separate. What they do attempt to do in this disclaimer, if your honor please, is to ask this court to reissue this patent, and by so doing they ask this court to do that which it is powerless to do. Now, they say we disclaim 9, 10, and 11 except where the results obtained are the results obtained by the use of oil in quantity amounting to a fraction of one per cent on the ore. I tried to understand the excuse presented to the court this morning for this character of disclaimer, but I could not. I am perfectly willing, however, to attribute that to my own lack of intelligence rather than to the clearness of explanation by Mr. Williams. But, be that as it may, the request here is a request for a reissuance of this patent; and from the date of the decision of the Supreme Court of the United States on December 11, 1916, to this very hour, there is no disclaimer within the law in the patent office or in this court or anywhere else. This is not a disclaimer. To use the homely language that I referred to but the expressive language, of the distinguished judge who decided the Motion Picture case, they are endeavoring to eat their cake and have it too.

And, as has thus been suggested, there is no foundation in the body of any specification for any claim as that here attempted to be
made in that disclaimer. So, if your honor please, it takes
2226 but a perusal of this paper, so-called disclaimer for your honor to determine that they are now saying, "We waive it, but we wish to hold a part of it." Now, by taking that paper by the four corners and examining it briefly, they must purge themselves of their deception in the manner which the law imposes by a renunciation of these invalid claims; they must come in and say in the very language of the court that declared them invalid, "we relinquish all rights to claims 9, 10, and 11, in order that we may enjoy the fruits of that which this court has decreed to be good," and until they do that, they have no place in a court of law, much less in a court of equity. Even if it were not for the rule of law which so clearly demands a compliance with these provisions, in equity and good conscience, they could not be heard to come into a court of equity asking equitable relief unless they approach the Chancellor with clean hands, which the maximum of equity demands. But here is a statute which limits their right, it gives them an opportunity to save something if they do a certain thing. It carries with that

the forfeiture of all that they might claim if they refuse to do it. In the case of National v. Stecher, 81 Fed. 395, the following was held; where the limitation or requirement of the disclaimer pertains to an invention which would require an amended specification, a disclaimer is not the proper method. It means a reissue, and that is exactly what they have asked here and they cannot obtain that relief here. So we submit this question to the court with full confidence that we have come well within the rule of law in this
2227 objection, and we believe that the decisions of the Supreme Court of the United States upon this all important question, without the shadow of a doubt, uphold the position here taken by us and that in view of that condition and in view of the fact that up to this hour they have not filed a disclaimer but tenaciously cling to that which the Supreme Court has said they were not entitled to, we maintain that in the light of these combined conditions we are entitled at this time to have this objection sustained and this patent declared invalid by reason of the fact they have shown by their actions that they do not believe that their rights are amenable to the plain provisions of the law.

Mr. Kenyon: I did not anticipate that this disclaimer question would be argued at this time and haven't all my authorities at hand, but can present them in a memorandum without much delay, and can present now an outline of what they show.

I was not concerned in the Motion Picture case against Laemelle to which Mr. Kremer referred but I was engaged in prior litigation between the same parties where a disclaimer question arose. The particular question to which Mr. Kremer refers—the particular case to which Mr. Kremer refers was brought after a reissue had been taken of the Edison Motion Picture Camera patent. Prior to the taking of this reissue, litigation through two or three years, of a very strenuous character, proceeded upon the unreissued patent up—it had previously been reissued for another purpose—and there the defense was unreasonable neglect and delay in filing a dis-
2228 claimer, and the delay there had been four years and a half after the Circuit Court of Appeals in New York had a second time held a certain claim 4 invalid and too broad and certain other claims valid and not too broad. The plaintiff, after that decision, in 1907, had gone forward and enforced the decision of the Circuit Court of Appeals as to the validity of claims 1, 2 and 3, taking advantage of it created a monopoly of the motion picture business under claims 1, 2 and 3 of that patent, and doing nothing as to the claim 4 that had been decreed invalid by that Circuit Court of Appeals once in 1902 and again in 1907. And I will say that on both occasions, in 1902 and in 1907, petition for a writ of certiorari had been made to the Supreme Court from the decision of the Circuit Court of Appeals and had been denied. So that that decision, as to claim 4 being invalid in that litigation, stood as the last holding of the highest court to which the case could go. And in Motion Pictures Company against Yankee Company, (187 Fed. 1007) we stood upon that defense of unreasonable neglect or delay as a defense to a motion for a preliminary injunction upon claims 1, 2 and 3

which had been held valid, the invalid claim 4 was not there in suit. The Circuit Court of Appeals denied the motion for injunction because there was so much doubt on the question whether the delay of four and a half years had been too long. The plaintiff argued in that case that it was not too long and the court was in doubt whether four and a half years was too long, but it denied the motion for the preliminary injunction, expressing its doubt, where-
2229 upon the plaintiff reissued, striking out that claim 4, substituting for it a corresponding claim 4 limited as claims 1, 2 and 3 had been, and adding another claim 5 as to some other details, and it was then subsequently so reissued with that same restricted claim four as well as claims 1, 2, 3 and 5. The judge held that the reissue was good, whatever the doubt about there having been previously an unreasonable neglect or delay in filing a disclaimer. But no one in that whole litigation from beginning to end pretended that a delay of a few months would have constituted unreasonable delay or that anything other than this long interval of four or four and a half years during which time the plaintiff was enforcing by countless suits and motions for preliminary injunctions the claims 1, 2 and 3,—that part of the decision of the court that had been favorable,—and had treated with contempt, the part of the decision of the court that had been unfavorable.

Now, on this general question of unreasonable neglect or delay, I have, I think, studied every case that has ever turned upon that question or discussed it from any point of view, and I have yet to know a single instance of a patent having been declared invalid because of unreasonable neglect or delay in filing disclaimer.

In Mason v. Bushnell, 96 Fed. 238, where the delay was from May when the court spoke—it was there a Circuit Court of Appeals—to July when the disclaimer was filed, although the argument was made that that was too great a delay the court brushed it aside with impatience. "There is no force"— said Judge Lacombe, speak-
2230 ing for the Circuit Court of Appeals in the Second District— "in the contention that there has been any unreasonable delay in filing the disclaimer. Defendant insists that the owners of the patent should have realized the necessity of so doing when the evidence as to prior use of a narrow tempered slip in circular saws and back saws was introduced in the Jennings case. (November 28th, 1902). But the Circuit Court in that case, with such evidence before it, did not consider disclaimer necessary. It was only when the decision of this court was filed, May 28th, 1915, that the owners of the patent were apprised of the necessity of disclaimer, and they filed it in July, 1915. They certainly acted with reasonable promptness."

I will call to your attention other illustrations of delay of that sort, from a month, three months, six months—I haven't them here at the minute—where the courts have brushed aside the suggestion that the delay was unreasonable. Courts, under such circumstances, take the reasonable view that in matters of such importance as a disclaimer, counsel and the parties are entitled to do the thing deliberately, to do the thing with care, with thoughtfulness, with

consultation, with re-consultation before the act is done. Because what is a disclaimer? It is a surrender for all time, irrevocable by the party interested, beyond the power of any court in the land to recall to him, irrevocable beyond any power of the land except that of Congress to reinstate him with what he has by that act dedicated to the public. It is the most solemn sort of a dedication of
2231 something to the public which he can never recall, which he can never thereafter contend in any litigation belongs to him. It has gone into the public domain by that solemn act of his of filing at Washington a disclaimer notifying all the public that they are free to use the thing disclaimed, so far as he is concerned, and so far as that patent is concerned. A reasonable man, when the property is of value and importance, a reasonable man would take time to consult one counsel, and to consult another counsel and to consult associates across the water, if there those associates lived. They have the right to take reasonable time before taking such a step as that. Now, we do not know whether the defendant in the Hyde case is going to petition to the Supreme Court for rehearing of that case or not. The defendant in the Hyde case has the right to file with the Supreme Court at Washington a petition for rehearing of that whole case.

The Court: How long?

Mr. Kenyon: Up to next October.

The Court: You have the same right?

Mr. Kenyon: We have the same right; until we disclaimed this overplus of claims 9, 10 and 11, we had the same right until next October to file a petition in the Supreme Court to review and rehear that part of their decision and mandate which refers to claims 9, 10 and 11. I say that time cannot possibly, in the strictest legal interpretation or in equity, that time cannot have begun to run against us until the expiration of that right of ours, which would be the last day of September of 1917. Now, what harm has come,
2232 because of our delay of 74 days of pondering; what harm has been occasioned, to anybody? Mr. Kremer suggested that we have by not disclaiming been continuing to assert claims 9, 10 and 11. I take issue with him there. We have not asserted these claims against anyone; we have not filed a bill of complaint against anybody alleging infringement of these invalid claims since the Supreme Court pronounced them invalid. We have not taken a step in any litigation where that position has been asserted. We have not asserted that in literature; we have not asserted that against the trade. We have taken, deliberately and carefully, time enough to consider what the Supreme Court decision means because that was the first great question we had to decide. What did it mean? What were our rights and privileges under the law, in view of that decision? It was then our duty to consider the form that our disclaimer should take and to consult with all of those whose property it was. And, above all, we had to decide whether to go back to the Supreme Court with a petition for a rehearing and ask them to change that part of their holding. That was an important matter and a difficult matter for us to decide; and the opinion of the Su-

preme Court is expressed in such a way that we have had real difficulty in understanding what it really meant and what duties and obligations it really placed upon us. Has the defendant, by reason of this delay, during this period of 74 days, done anything it would not have done if we had earlier filed a disclaimer? There is no evidence or suggestion of anything of the kind. The suggestion
2233 that we have unreasonably neglected or delayed to file this document should be brushed aside as unworthy of consideration. It has not a consideration of substance supporting it; of equity supporting it, of common sense supporting it.

Men, in the great affairs of life, do not act over-night. They cannot act within a week. They may well delay a month. They may well delay three months. That time came out of the term of our patent. It cost us something but it cost the defendant nothing. In no way has it harmed the defendant.

Now, on the question of the proper nature and character of this disclaimer. It is the sort of disclaimer that is within the exact purpose and function of the law and the rule of law in its remedial enactment, that where a patent covers more than it ought to cover and that more can be eliminated by simply cutting off, then the patentee, by filing a solemn document at Washington called disclaimer, cutting all overplus off, may make his patent good for the residue for what is left, enabling him to sue for infringement one who infringes what is left, and not abating any suits previously begun, but affecting them only in the matter of costs, the disclaimer inuring to the benefit of the suit, in the middle, at the end, at the beginning, anywhere in the pending litigation, and benefiting the plaintiff in future litigation just to the extent that it validates his patent for what is really his invention, disclaiming only an overplus or what is not his invention. The statute says nothing about claims. The disclaimer statutes say nothing about claims. It only knows
2234 what the patent covers and includes and it is as applicable to a patent with only one claim as it is to a patent with one hundred claims in it.

Whereupon an adjournment was taken until 2:00 o'clock P. M., Monday, April 16th, 1917.

2 o'clock P. M.

Mr. Kenyon (continuing): If your honor please I have now my fuller notes with me on the cases on this subject. I will first quote from the case Carnegie Steel Co. vs. Cambria Co., 46 L. Ed. 968, at 985; 1901, Justice Brown.

"Upon the hearing defendant seems to have insisted that certain portions of the specifications were broader than the second claim. Those parts of the specifications therefore were disclaimed. As we had occasion to observe in Sessions vs. Romadka, 145 U. S. 29, 36 L. Ed. 609, 12 Sup. Ct. Rep., 799, 'the power to disclaim is a beneficial one, and ought not to be denied except where it is resorted to for a fraudulent and deceptive purpose.' In that case the plaintiff

was permitted to enter a disclaimer of all the claims but one in suit, the patentee having included in the patent more devices than properly could be the subject of a single patent. In the case under consideration the disclaimer was not of a claim, but of certain statements in the specification, which if retained might be construed to have the effect of illegally broadening the second claim. The first statement disclaimed was that the invention might be prac-
2235 ticed by merely receiving a number of small portions of metal taken from different ladles, the mixing being performed merely by the act of pouring into the charging ladle. The use of the word 'merely' ignored the steps embodied in the second claim, where the mixing is not performed by merely pouring together the several charges into a ladle, but by maintaining a permanent quantity of metal in the reservoir, into which charges were alternately added and from which they were withdrawn. The other clauses were intended to disclaim the casting of the metal into pigs. We think there is no force in the criticism that a disclaimer may not extend to a part of the specification, as well as to a distinct claim. Hurlbut v. Schillinger, 130 U. S., 456, 32 L. Ed. 1011, 9th Sup. Ct. Rep. 584; Schillinger v. Gunther, 17 Blatchf., Fed. Cas. No. 12458; Schwartzwalder v. New York Filter Co., 13 C. C. A. 380, 26 U. S. App. 547, 66 Fed. 152. Had the purpose of the disclaimer been to reform or alter the description of the invention, or convert the claim from one thing into something else, it might have been objectionable, as patents can only be amended for mistakes of this kind by a re-issue. But the disclaimer in this case appears to have been made to obviate an ambiguity in the specification, and with no idea of obtaining the benefits of a re-issue. If the clauses had the effect of broadening the patent the disclaimer removes the objection. If they did not, the disclaimer could do no harm, and can not be made the subject of criticism."

I will also refer to Tuck v. Bramhill, 3d Fish. Pat. cases,
2236 400, Fed. Cas. 14213, and Taylor v. Archer, 4 Fish. Pat. Cas. 449, Fed. Cas. 13778.

I note that in Carnegie v. Cambria Iron Wks., there was this situation, that the claim might have a broad or a narrow scope. The broad scope was too broad, the narrower scope covered the real invention. This language in the specification left it in doubt whether the claim covered the broad field or the narrower field. The patentee filed a disclaimer, thereby himself asserting and admitting the narrow scope by disclaiming anything over and above the actual invention. I have the form of that disclaimer here. After the formal part it says: "Enter this disclaimer to those parts of the specification which are in the following words, which your petitioner desires to erase from the specification," then it enumerates—"or the metal is cast into pigs or otherwise used." That is all of the disclaimer, and it did not change a word in the claim, but it took out of the specification matters that might have compelled the court, in construing the claim, to hold it and construe it as of a broader field than the real invention, and therefore wholly invalid.

Now, in Tuck v. Bramhill, 6 Blatchf., 95, after the testimony on

both sides had been put in before the examiner, the plaintiff filed a disclaimer setting forth that he was the owner of the patent, and making his disclaimer, "to that part of the claim which covers the packing therein described without a core," thereby causing the claim to include only the packing formed out of saturated canvas, so cut as
2237 that the thread or warp shall run in a diagonal direction from the line or center of the roll of packing, and rolled into form in connection with and around an India rubber core, or one of other elastic material, meaning the said claim to include only the combination of an elastic core, with saturated canvas, having threads running in a diagonal direction, as described in said patent, wound round the same." The court says: "It having been shown that the forming of the roll in the manner described, without the core, was old, the next question is whether the plaintiff could disclaim, as he has attempted to do, the forming of the roll without the core, and limit to the forming of the roll with the core." The seventh section of the act of March 3d, 1837 (5 U. S. St. at Large, 193) provides for the making of a disclaimer, where a claim is too broad, and claims more than that of which the patentee was the original or first inventor; but the disclaimer can not be made unless some material and substantial part of the thing patented is truly and justly the invention of the patentee, and, in such case, he is authorized to make disclaimer of such parts of the thing patented as he does not claim to hold by virtue of the patent. The defendant contends, that the claim of this patent is not equivalent to two claims, and that, therefore, under the statute, the patentee has no right to disclaim anything in the claim. But this objection has been already disposed of. The forming of the roll within the core is one material and substantial part of the thing patented. The forming of the roll with the core is another material and substantial part of the thing patented.

"The patentee was not the first inventor of the former; he
2238 was the first inventor of the latter. The two are clearly separable and distinguishable. The claim is too broad, and claims more than that of which the patentee was the first inventor. A clear case, therefore, existed, under the 7th Section of the Act of March 3d, 1837, for a disclaimer by the patentee of so much of his claim as covered the forming of the roll without the core. The disclaimer goes exactly to that extent. It disclaims that part of the claim 'which covered the packing therein described without a core'; and then it goes on to state what the claim will be after such disclaimer, namely, that it will 'include only the packing formed out of saturated canvas, so cut that the thread or warp will run in a diagonal direction from the line or center of the roll or packing, and rolled into form in connection with and around an India rubber core, or one composed of other elastic material', and that it will 'include only the combination of an elastic core with saturated canvas having threads running in a diagonal direction as described in the said patent, wound around the same.' This disclaimer is unambiguous, and leaves the claim as if it had originally claimed only such combination. It is substantially just such a disclaimer as the Su-

preme Court in Silsby v. Foote, 14 Howard, 218,221, held to be valid. The claim there was to 'the application of the expansive and contracting power of a metallic rod, by different degrees of heat, to open and close a damper, which governs the admission of air into a stove, or other structure, in which it may be used, by which a more perfect control over the heat is obtained than can be by a
2239 damper in the flue.' It having been shown that the application of the expansive and contracting power of a metallic rod, by different degrees of heat, to regulate the heat of other structures than a stove in which the rod was acted upon directly by the heat of the stove, or the fire which it contained, was not new with the patentee, he entered a disclaimer 'to so much of said claim as extends the application of the expansive and contracting power of a metallic rod by different degrees of heat, to any other use or purpose than that of regulating the heat of a stove in which such rod shall be acted upon directly by the heat of the stove, or the fire which it contains.' The Supreme Court sustained such disclaimer as a good disclaimer under the 7th section of the Act of 1837."

The original claim is found in Patent Office reports of 1855, page 573, and was as follows:

"The forming of packing for pistons or stuffing boxes of steam engines, and for like purposes, out of saturated canvas, so cut that the thread or warp shall run in a diagonal direction from the line or center of the roll and packing, and rolled into form either in connection with the India rubber core or other elastic material, or without, as said core."

So the disclaimer practically strikes out the words "or without", from the claim leaving it thereby covering a narrower field. Now, to contrast the remedy of disclaimer with that of reissue, the statute is that wherever, similarly without fraud and by inadvertence,
2240 accident or mistake, an error has been made in taking out the original patent,—both statutes, reissuing and disclaimer statute are founded upon that,—and a change in, or additional specification or claim is necessary,—then reissue must be resorted to, and with its heavy penalty; first that in a reissue you must surrender your original patent, and with the surrender of that original patent abates every suit for infringement that has been begun on it, abates every claim of profit and damages because of infringement—that is all wiped off the slate by the act of surrendering the original patent as a condition for getting a reissue of patent. And in addition, in the Patent Office, the Patent Office examiners have a responsibility with respect to a reissue correction, and they have none with respect to a disclaimer. Their responsibility with respect to the reissue correction is that they re-examine the entire field of validity and novelty, and consider over again every claim made and the responsibility for doing that is upon the Commissioner and his examiners, and the proceeding is long and expensive and may involve interferences, just as the original application for patent. So the reissue statute, while it is remedial and beneficial,—it was passed in 1882, and it was passed to mitigate the severity of the situation about which Mr. Kremer spoke, that where there is a single claim too broad in the

patent, the whole patent and every claim in it is invalid; that was common law; the English law at that time. To mitigate that, came this reissue statute, and five years later,—1836 or 1837, to meet the case where a mere cutting off of part of the claims was re-
2241 quired, came the disclaimer statute with its greater benefit, namely that it involved no surrender of anything in the past, no surrender of the old patent or of claims of infringement; no re-examination in the Patent Office; no proceeding by the Commissioner of Patents in which he had a function and no responsibility or duty upon him; it was simply a formal—the most formal possible sort of a gift to the public, a dedication of something that could be distinguished or that was left and could be dedicated to the public by simply cutting it off from the claim.

Now, another example. Electric Accumulator Co. v. Julien Electric Co., 38 Fed. 117.

(Coxe C. C. 2, 1889.) There is in that case a very long and interesting discussion of the whole subject of disclaimers by Judge Coxe away back in 1889, that your Honor will find interesting and useful. On page 137 Judge Coxe discusses the facts in the case before him. There was only one claim there and it covered the application of an active coating to a supporting core, for the purpose of a secondary or storage battery; the application in the form of a paint, paste or cement, or by galvanic deposition or chemical precipitation or otherwise. That was the claim, the electrode made in that way.

Says Judge Coxe: "The part of the invention which bona fide belongs to Faure is an electrode in a secondary battery consisting of a support coated with an insoluble layer of active material in the form of a paste, paint or cement, so as to be or instantly become spongy, etc. It was this that the scientific world recognized
2242 as a discovery of great merit and importance. It was this that the distinguished Scotch electrician (Lord Kelvin) regarded as 'marvelous.' And this was the result of Faure's genius. No one anticipated him. It is honestly his. But what he did not invent was an electrode in a secondary battery, coated with a soluble layer of active material. Neither did he invent an electrode on which the active material is applied by 'galvanic action or chemical precipitation, or otherwise.' The claim is broad enough to cover all these forms probably, and some of them certainly. What he is not fairly entitled to he wishes to give up, and keep what is certainly his own. He does not seek to broaden his patent, but greatly to restrict it. No one will infringe unless he constructs his battery in the one way to which the patent will be confined. This is the patentee's way, and it has many distinguishing characteristics which differentiate it from the ways pointed out by others. The matter to be relinquished is distinct and separate, and can be exscinded without mutilating what is left. No amendment is necessary. The claim, read in the light of the description, is too broad. It is sought to limit it. The disclaimer suggested will not make a new patent, or a different invention. The invention is fully described in the specification, and the limited claim will stand on that description.

After giving the subject a most careful consideration it is thought that Faure was the originator of the invention just described and that it would be unjust to him to declare the patent wholly void, if he is willing to restrict it to what is lawfully his own."

2243 The disclaimer is found in 47 O. G., 276, April 16, 1889.

"The Electrical Accumulator Co., New York, N. Y., enters its disclaimer to—

'From the first claim of said letters patent, No. 252,002, any electrode of a secondary battery coated with an active layer of absorbtive substance, to which this active layer is wholly applied otherwise than in the form of a paste, paint, or cement, practically insoluble in the electrolytic liquid.'"

So there is the identical sort of emasculating exception, as Mr. Kremer called it, that occurs in our case, the exception being the residue that was left, the invention that was really made, attained by the exscinding of everything else. In addition the disclaimer cut out these phrases from the specification. "In the form of a deposit by galvanic action or chemical precipitation or otherwise," also in another sentence the words "in any suitable way," also in another place the following "the plates *a* can be coated with an active porous layer in any suitable way." Those phrases are struck out.

Now, another illustration, Thompson v. Bushnell, 96 Federal 238. This was a simple little mechanical case. The patent after the disclaimer was held to be valid; it had been held invalid before the disclaimer. The disclaimer was filed and the patent held valid, and the court discusses the question of the disclaimer.

"It was intimated that the patent could be sustained only if limited to hack saws and band saws. Acting upon this sug-

2244 gestion, the owners of the patent on July 18th, 1895, filed a disclaimer in the Patent Office 'of so much of said claims as covers circular saws and hack saws, leaving said claims to include only hack saws and band saws.'"

"Thereafter they brought this suit, and upon proof that defendant had sold some saw blades that in the opinion of the court were 'either hardened to the base line of the teeth, or so near it that the variance from the distinctive fractional tempering of the patent was trivial,' the Circuit Court entered an interlocutory decree for injunction and accounting, from which decree this appeal is taken.

"The appellant contends that the disclaimer is not a proper one, and is therefore void. The theory of this contention is that there is no separate invention, and that, inasmuch as the different kinds of metal saws known to the art are distinguished from each other by their particular kind of mounting, a restriction of the claim to any one kind of saw is practically adding to the claim a new element, to wit, the kind of mounting. Reference is made to Machine Company v. Searle, 8 C. C. A., 476, 60th Fed. 82, and to Hailes v. Stove Co., 123 U. S. 582, 8 Sup. Ct. 262, where it is held that disclaimer cannot be availed of when 'it requires an amended specification or supplemental description to make an altered claim intelligible or relevant.' But this cause is not within such ruling. The invention, and the sole invention, of the patent, as was held in the Jennings

case, consisted in locating the temper line practically coin-
2245 cident with the bottoms of the teeth. It is manifest that this location of the temper line might be applied to any one of the four well known varieties of saw—circular, back, hack, or band; but, if applied to circular or back saws, it would subserve no useful purpose, and the patent might fairly be held void for want of utility. When applied to hack or band saws, however, it would accomplish 'a desirable result,' as the Circuit Court and this court both held. The phraseology of the claim, however, read in connection with the specification, was broad enough to cover all four varieties of the class known as 'metal saws,' although as to two of them it was useful, and as to the other two useless. Certainly there was an actual, separable invention, and a specification and claim broader than the invention. In view of the fact that the four varieties of this class of saw were well known to the trade and their difference clearly recognized, as the evidence shows, no amended specification or supplemental description is required to make the new claim intelligible, and a disclaimer of circular and back saws leaves the patent in force as to the other varieties of the class.

"There is no force in the contention that there has been any unreasonable delay in filing the disclaimer. Defendant insists that the owners of the patent should have realized the necessity of so doing when the evidence as to prior use of a narrow tempered slip in circular saw and back saws was introduced in the Jennings case (November 28th, 1892). But the Circuit Court in that case, with such evidence before it, did not consider disclaimer necessary. It
was only when the decision of this court was filed, May 28th,
2246 1895, that the owners of the patent were apprised of the necessity of disclaimer, and they filed it in July, 1895. They certainly acted with reasonable promptness.

Now, another illustration. Schwarzwalder v. New York Filter Company, (66 Fed. 152), Second Circuit Court of Appeals, 1895. In that case a part of the specification was disclaimed. The court says: "The claim is as follows:"—Here again, there was only one claim—"The method of arresting and removing the impurities from water during an interrupted passage of same from a supply pipe into a filtering apparatus, then through a filter bed contained therein—" I will read the latter part: "Which method consists in introducing into the water, simultaneously with its passage through or into the filter, a substance which will sufficiently coagulate or separate the impurities to facilitate their arrest and removal by the filter bed, thus obviating the necessity of employing settling basins." It was narrowed down with respect to these substances, so note the language: "A substance which will sufficiently coagulate or separate the impurities to facilitate their arrest and removal by the filter beds, thus obviating the necessity of employing settling basins."

Now, continues Judge Wallace: "After a litigation upon the patent in a suit in the United States Circuit Court for the Northern District of Illinois, in which, in February, 1889, the bill of infringement was dismissed, and on July 27th, 1889, the owner of the patent filed in the patent office a disclaimer of that part of the specification

of the patent which is in the following words: 'I do not
2247 confine myself to the employment of persulphate or perchloride of iron or permanganate of potassia, but make use of any other suitable agent which is capable of coagulating impurities of the liquid and preventing their passage through the filter bed. Neither do I limit myself to any particular proportion of quantities of the coagulating agents, as they may be varied according to circumstances and the character of the liquid to be treated. Nor do I confine myself to any particular liquid although I contemplate chiefly the purification of water in large quantities.' "

Now, all of that broadening language and specification was stricken out by the disclaimer after the unfavorable decision in Illinois.

"But it has been urged for the appellants, that the patent before the disclaimer covered broadly any continuous process of filtration of any liquid in which the treatment with any coagulants or reagents is adopted and that the validity of the patent as regards the defense of want of novelty is to be tested by its original terms and scope. We are aware of no principle which permits a patent to be defeated for want of novelty in respect to the subject-matter which has been eliminated from it by a disclaimer. The office of a disclaimer is to enable the patentee to save himself from the peril of such a defense. Matters which have been properly disclaimed cease to be a part of the invention, and, as was said by the Supreme Court in Dunbar v. Myers, 94 U. S. 104; 'It follows that the construction of the patent must be the same as it would be if such matters had never been included in the description of the invention or the claims of the specification.' "

2248 Judge Wallace, continuing says: "It is also urged for the appellants that the effect of the disclaimer was to limit the method of the patent to one in which perchloride or persulphate of iron is used as a coagulant. If these coagulants, only, instead of coagulants 'Such as perchloride or persulphate of iron', had been mentioned in the description of the invention, there would be much force in the argument; and it might well be held that by disclaiming 'the use of any other suitable agent which is capable of coagulating the impurities,' all equivalents would be excluded. The literal effect of the disclaimer is to confine the claim to a method in which no other coagulants are employed except 'such as salts of iron.' It is to be observed, however, that the part disclaimed is not part of the descriptive matter, but a recital intended to enlarge the scope of the claim. The disclaimer consequently operates only to expunge from the claim what otherwise would, by force of the recital, be incorporated into it constructively. Obviously, it was intended to obliterate the recital from the patent, and to have no other effect. The patent, after the disclaimers, is to be read exactly as though the recital had never been inserted. Thus read, it is clear that the claim covers the use of any coagulant having similar properties to the salts of iron, which was a recognized equivalent."

Another illustration. Simplex Company vs. Pressed Steel Car Co., 189 Fed. 70, Second Circuit Court of Appeals. There the patent

after disclaimer was held valid and infringed. Judge Coxe, speaking for that court says: "The specification contains a statement that, though the best results are obtained by keeping
2249 the tension member straight, if the construction be varied by bending the tension member and keeping the compression member straight it will still be within the spirit of the invention.

"The Circuit Court, however, permitted a disclaimer to that part of the specification, so that the patent is now limited to a bolster having a straight tension member and a compression member with its end bent at a point approximately over the place of support. That the court was entirely justified in permitting a disclaimer is, we think, clearly established by the authorities. The effect of the disclaimer was not to broaden the claim, but to limit it to the construction described and shown, of a straight tension member and a bent compression member. Until this disclaimer was allowed it was possible to contend for a construction of claim 6 broad enough to include a structure described in the language disclaimed, viz., a straight compression member and a bent tension member. That this was a proper case for a disclaimer and that the language disclaimed is no longer a part of the specification, are propositions which are sustained by the following authorities: Dunbar v. Meyers, 94 U. S. 187, 24 L. Ed. 34, and cases cited in Accumulator Co. v. Julien Co. (C. C.) 38 Fed. 117, 133-136.

"In Carnegie Co. v. Cambria Co., 185 U. S. 403, at page 436, 22 Sup. Ct. 698, at page 711, 46 L. Ed. 968, the court says:

'Had the purpose of the disclaimer been to reform or alter the description of the invention, or convert the claim from one
2250 thing into something else, it might have been objectionable, as patents can only be amended for mistakes of this kind by a reissue. But the disclaimer in this case appears to have been made to obviate an ambiguity in the specification.'"

Now, says Judge Coxe, "The sole effect of the present disclaimer is to limit the sixth claim to a structure embodying Bauer's actual invention and strictly within its terms. The statement eliminated by the disclaimer was unnecessary and was not advisedly inserted, but there is nothing of which to predicate a fraudulent intent. The statement is gone and to that extent the atmosphere is cleared."

And still another, Libbey v. Mt. Washington Glass Co., (26 Fed. 757), Judge Colt, 1886: "The claims of the patent are as broad as the specification, and are not limited to any particular compound. Since bringing suit, the plaintiff has filed a disclaimer under the statute, in which he limits his claim to the gold-ruby compound. This the plaintiff had a right to do. Under the authorities cited by the plaintiff, this was a patent where a part could be properly disclaimed. It did not require the importation of anything new in the specification, but simply the elimination of a part of what was originally claimed. A disclaimer can be made after suit is commenced.

"The argument of defendants that they have to meet a different case since the disclaimer, and that, therefore, a supplemental bill

should be first filed, and then another motion for a preliminary injunction, does not seem to have much force in this case.

2251 The defendants have long been apprised of the real nature of this controversy, and that Locke's claim was confined to variegated glassware made from gold-ruby. This was the main issue in the interference proceedings in the patent office between Locke and the defendant Shirley, where the examiners in chief, in a well considered opinion, decided in favor of Locke as the prior inventor. The disclaimer has been filed since August 29th, and the defendants, so far as appears, have had sufficient time since then to prepare their defense to this motion. We do not see how their rights have been prejudiced in any degree by the disclaimer."

One other example—there are an endless number of them in the books—Page v. Dow, 200 Fed. 72, 1912, Hazel Judge.

There the patent had been declared valid and the claim infringed. "The record before the court is the result of a supplemental bill averring infringement of claim 12, which heretofore was held not infringed, and which was amended by disclaimer filed in the patent office after affirmance by the Circuit Court of Appeals of the original opinion. It was held by me on rehearing that the 'constantly acting source of power,' an element of the original claim 12 did not mean the constantly rotating shaft with which the machine is provided, but referred solely to the electric motor which drives the shaft as the said source of power.

"Claim 12, as amended by the disclaimer, reads substantially as follows:

2252 "'12. In a printing telegraph receiver, the combination of a type-wheel, paper-feeding mechanism, a constantly rotating drive shaft, and means for continuously feeding the paper without feeding the type-wheel as long as said drive shaft is supplying power, for substantially the purposes set forth.'

"It will be noticed on comparison with the original claim that the words 'a constantly rotating drive shaft' have been substituted in place of the words 'constantly acting source of power' * * *.

"The defendant insists that the disclaimer changes the character of the invention and substitutes a different element, but I am persuaded by the proofs to the contrary. To substitute the words 'constantly rotating drive shaft' for the words 'constantly acting source of power' did not, in my opinion, alter or change the invention; nor was it the addition of an equivalent element for one that had been abandoned. The effect of the disclaimer was merely to limit the original claim, which was thought too broad, to a constantly rotating drive shaft actuated by a constantly rotating motor. Disclaimers of this description, when filed within reasonable time of the discovery that a disclaimer is necessary, have many times received the approval of the Federal Courts." A long citation of cases.

Then, there is a most excellent discussion of this whole law of disclaimer in Suddard v. American Motor Car Company, 163 Federal, 852, which I will not go into here, simply an interesting case

to study and a long essay on the subject, a very able treat-
2253 ment of the whole question.

Now, our disclaimer here, what is it? It is simply a cutting off and excinding from claims 9, 10, and 11 of that excess, whatever it may be—we don't know—of that excess which caused the Supreme Court to say and to hold these claims invalid and too broad.

And down to what did we cut these claims? We cut these claims down to the exact invention which the Supreme Court says we made and to which the Supreme Court says our patent must be confined. We quote the language of the Supreme Court in our disclaimer. This is the language of our disclaimer following what the Supreme Court says, "Does hereby disclaim from claims 9, 10 and 11 of said letters patent"—the universal, the general, the accepted method of disclaimer—"We do hereby disclaim from these claims any process of concentrating, the process of concentrating powdered ores,"—these words are quoted from these three claims—"process of concentrating powdered ores," here is the way each one of these three claims starts. "Excepting"—we disclaim everything "excepting,"—now we are not going to disclaim what the Supreme Court has said is ours, not one mite of what the Supreme Court has said is ours, not one jot or tittle of what the Supreme Court has said is ours are we going to disclaim, are we going to abandon, are we going to dedicate to the public; but everything else, everything except that, we dedicate to the public. Any process—we disclaim from these claims any process
of concentrating powdered ores excepting—now, we put in
2254 the Supreme Court's definition—"where the results obtained
are"—now we don't use quotation marks, but they might have been used—"the results obtained by the use of oil" in a quantity "amounting to a fraction of one per cent on the ore." Now, whatever—that is it is based on this language of the decision of the Supreme Court, "and the patent must be confined to the results obtained." The "patent must be confined to the results obtained." Now, the Supreme Court identifies these results this way: "By the use of oil within the proportion often described in the testimony and in the claims of the patent as a proportion amounting to a fraction of one per cent on the ore." So we disclaim everything from these claims, everything that would be within the language of these claims 9, 10 and 11, excepting where the results obtained are (as the Supreme Court says we are entitled to claim), the results obtained by the use of oil in a quantity amounting to a fraction of one per cent on the ore.

It was our purpose and intention to disclaim from these claims and so from the patent everything that the Supreme Court held or thought was not ours. It was our purpose and intention to retain within the patent and within these claims of the patent everything that the Supreme Court has held is properly ours, and in the language of the Supreme Court where it defines what is properly ours—that language we may not know what it means, that language is to be construed perhaps by this court, perhaps by the Supreme Court itself, perhaps by other courts, but whatever it means as used by the Supreme Court, that it means as used by us in our disclaimer.

2255 If by "results" the Supreme Court meant the rising of this froth, and the concentrating in that way, that we propose to hold and claim by these claims 9, 10 and 11 of our patent. If the Supreme Court meant to contrast a result which we could not hold, the Cattermole effect of granulation and securing the concentrating of the ore in that way, we disclaim that by our disclaimer. Our disclaimer leaves as a residue in the patent, in our intention, nothing but that subject matter which the Supreme Court has said is justly ours. Our disclaimer leaves in the patent in and by claims 9, 10 and 11, in the legal effect, nothing but what the Supreme Court has held is justly ours, and it is a proper case for disclaimer and is not a case for re-issue, because to attain that end nothing has to be added to the complaint, not a word to the specifications of the claims, no different description need be given anywhere, nothing has to be done but to deduct the overplus, whatever that overplus may be, dedicate that to the public, and that we do by our disclaimer; and nothing more do we do by our disclaimer.

Now, if your honor please, the other claims in the patent may fill the whole measure of that invention, and they may not. That is a question that may arise in future litigation, possibly in this. If they were not broader than the real invention the Supreme Court would hold them valid as it did even though they were narrower.

A man may claim less than he has a right to claim as new. So the Supreme Court would hold valid any claim that was less
2256 narrow in its scope than the real invention.

For example, it has validated some claims that are limited to heat. Our invention is not limited to heat; it is broader than that. Claim No. 3—that was inside the broad scope of the invention. Claim No. 2 is limited to the use of an acidified pulp. The Supreme Court has held No. 3 and No. 2 valid. No. 2 is narrower than our entire invention. Some of the other claims validated are limited to very microscopic quantities of oil. An example is claim No. 5, limited to from .02 up to .5; clearly that is narrower than the purview of our invention as defined by the Supreme Court, because it has said that the patent must be confined to the results obtained by the use of any fraction of one per cent. Claim No. 5 is a claim of one half of one per cent, or under. So the validating of those claims does not mean that the Supreme Court was of the opinion that they filled the whole bill, that they went to the utmost extent of our invention. When we come to claims one and twelve, they may fill the full measure of our invention or they may not; they are limited to the process wherein the oil referred to and that operates in the process is a fraction of one per cent—anything up to one per cent. That may be the full measure of our invention in the intention of the Supreme Court, and it may not. The Supreme Court, in contrast to that, said—"the patent must be confined to the results obtained when that amount of oil is used." Now, if somebody, within the language of claims 9, 10 and 11, obtains that result, although he may obtain it by
2257 using more than one per cent of oil, he is within that definition of what we are entitled to claim, which the Supreme Court has laid down for us and for you and for the defendant here,

and we think that that definition is the law of this patent, and in filing this disclaimer as to claims 9, 10 and 11 and disclaiming those claims down to the exact and whole subject matter of what the Supreme Court has said is fully and justly ours, we have done what we were privileged to do under the law; we have taken out what the disclaimer stated and by cutting off what was not justly our own, but in doing that we are not required to cut off one jot or tittle of what is our own, irrespective of whether the other claims are up to the full measure of that property or not. So we filed a document, a disclaimer, within the letter and spirit of the disclaimer statute, within the authorities of a half century, within common sense and reason, cutting off what was not ours and retaining what is ours, and adopting in that disclaimer for the definition of what is ours, the definition that the Supreme Court itself had given.

Now, to hold that a few weeks' delay in filing this disclaimer is fatal to the whole patent would be a farcical catastrophe, and absolutely without precedent in the administration of patent law and particularly of that statute since the year 1837 down to the present year, 80 years afterwards, and as to the form and substance of the disclaimer, it deals with substance and not with the form; it goes to the core of the matter. The Supreme Court has told us what we did not ourselves know before, or when we took out this patent, just
2258 what the boundaries of our invention are, and by this document we cut those three claims down exactly to that boundary, thereby insuring to ourselves that we have some claim or claims in this patent up to the full measure of that boundary, so that not a bit of the territory that belongs to us but what is claimed here.

Mr. Kremer: May it please your honor, I feel after having heard the argument of Mr. Kenyon that there was some reason why I should not have understood the statements of Mr. Williams in connection with the filing of the disclaimer; after having heard the argument just concluded I feel now that I should no longer speak from a standpoint of misgiving, but confidently assert that no disclaimer has been filed either within the meaning of the statute or within the intent of the decision of the Supreme Court. Instead of having eliminated anything from the scope of the patent or the claim of the patent, I assert that this disclaimer in its very language gives that claim the full breadth that it had before any attempted disclaimer was filed. Before discussing that, I want to say that I am sorry if I, in my argument, conveyed to counsel that I believed there was anything mystical in the use of the term "claim"; whether it is a single claim or one of a great number of claims, or whether there is only one claim in the patent makes no difference. It is the invention that the patentee must claim. In the case at bar it was the invention that Minerals Separation claimed. The invention of what? The invention of a process or of a result? I was astounded to hear these distinguished patent lawyers in their arguments to this court
2259 allege that the Supreme Court had ever said that they could patent a result, or to hear them assert that a result is patentable, because it is an elementary doctrine of patent law that a result is not patentable. So, disregarding this statement that a result is

patentable, we return to the process, and the process in this case is the only thing that is patentable. And what is that process? The Supreme Court—and as lawyers practicing before that court we are forced to accept the decision of the Supreme Court in the language in which it is given, and to comply with the law in connection therewith until that court itself modifies it or changes it—the Supreme Court held that the patent in this case was the patent of a process, not a result, wherein there was a quantity of oil of less than one per cent used. Now, they hold that claims 9, 10 and 11 are invalid. Why? Because they did not fall within the specification of less than one per cent, as it defines in this opinion the critical amount, and I say to your honor that by no forced construction can the effect of this decision be avoided by this plaintiff; by the artful use of words segregating a single line from the utterances of that court and reading it, so to speak, into a disclaimer, any more than if this court should say, "No, you can't do this, though if you do a certain thing then you will be permitted to do it." I could not argue on that that this court had said "No, you can't do it." They take a single line and by artful use of that line change the effect of the decision. They put a statement in the disclaimer which would render it absolutely meaningless. Can they be heard to contend, in the light of
2260 this decision, that the Supreme Court held that their invention embraced the use of an amount of oil, say, equal to three per cent upon the ore? 3.6 for instance, the Cattermole proportion, as I recall? That is a small amount of oil. It was that very feature, as it appears from the record of the Hyde case on file in this court and which is now before your honor—that was represented as a small amount of oil. It appeared that there was a resultant froth. It is true that counsel drew, as the records show, a metaphysical distinction upon the ground that there was more oil in the froth. Be that as it may, the Supreme Court in reviewing that record declared that their patent ceased at an amount within one per cent, and that claims Nos. 9, 10 and 11 were invalid. Why? Because there was a use of more than a fraction of one per cent. The merest tyro in reading that decision could place no other construction upon it, and yet in this disclaimer which is here now on file, and the only disclaimer that we have, it disclaims—note the artful manner in which it is put—it disclaims claims 9, 10 and 11, except as to the result obtained by the use of oil in a quantity amounting to a fraction of one per cent upon the ore.

In this verified record, which is before the court, it conclusively appears, and your honor saw the demonstration in this court room, that the result is the resultant froth; that is the result of the application of these processes; the result is the same, the resultant froth, and the Supreme Court has limited their patent to the use of less than one per cent of oil—they disclaim 9, 10 and 11, but at the same time assert that it extends to three per cent or four per cent or any
2261 other per cent, which any court, any place might at any time hold to be a small amount of oil. Therefore I say that they have disclaimed nothing; they have eliminated nothing, as was done in the Silsby-Foote case; they have not eliminated as was done in

the McCormick case or the Hull case, or any of the cases cited by the distinguished counsel for the plaintiff. It is a claim without a limitation; they have eliminated nothing. And in this court here and now, after that decision, they are asserting the right to claim all that they have ever claimed before the decision of the Supreme Court of the United States—hence, your honor, the delay. Hence the delay. It was the desire to artfully seem to yield, without yielding, and even though conquered in that respect, they are still unyielding. They are as unreconstructed today as the man who fired the first shot in answer to the one at Fort Sumter; they have yielded nothing in principle and they yield nothing in law. And so they have come to this court, and in language eloquent and appealing, in the lack of analysis—they say to this court—"Dare this court apply this rigorous rule of law and destroy what is ours or what would have been ours if we had only filed this disclaimer? Will we be forced to yield this valuable patent because we have not filed a disclaimer?" They have sought to avoid the provision of that law, and they must pay the penalty.

There was a statement made of which I took note at the time, in reference to their right to apply to the Supreme Court of the United States for a rehearing. That rule is simply the equity
2262 rule, and it permits any party to make application for a rehearing during the term in which the decision is rendered. There are two ways—we must not take these rules to be formed wrongly, because the rules are supposed to have been born and were born of intelligent thought directed to the conduct of litigation. They could have filed a petition for a rehearing, or they could have ordered this mandate down, and when they ordered this mandate down—and it is of record here whether physically present or not—it is filed; Mr. Williams offered it and it was accepted to be filed when it arrives—that is before the court, and when they have ordered that mandate down and have filed no petition, and when the rule of law required them to act in a manner that was expeditious and not to delay in doing what the decision of the Supreme Court required them to do—and they ordered that mandate down, then they stand in law as having surrendered their right to petition for a rehearing. So this is not an excuse for a delay in the filing of a disclaimer, and they have not filed a disclaimer within the meaning of the law.

It would be but a mere matter of repetition to discuss the law of this case, because I find no reason to differ with the principles of law read by Mr. Kenyon from his long and able brief. He has not cited a case that is in opposition to any that we have cited. The simple distinction exists between all of those cases in which he referred to the lapse of time, and the cases to which I referred this morning—the simple distinction exists that mine were utter-
2263 ances of the Supreme Court of the United States, and he never cited one single Supreme Court decision to your honor upon the question of the right to file a disclaimer after a decision by that court. That is the simple distinction between those cases. The only other distinction between the cases that I cited and those which Mr. Kenyon cited are that Mr. Kenyon sought to construe certain

cases as eliminating or yielding certain features of certain claims of patent, while in the cases I cited the yielding was an entire giving up of those rights claimed. I do not assert that they could not yield those claims in part, but where they yield them in part, they irrevocably and irretrievably surrender a part of what they did own; not what Mr. Kenyon referred to as a dedication; they only returned to the public what did belong to the public, and never was the property of the patentee.

So that is the distinction of the law of those cases, and we submit this matter to your honor, and do it, feeling that our position is even stronger in the light of the language of the disclaimer filed herein than it would have been if it had not been filed at all, because the reason is taken from their own disclaimer, that reason being, as I have just stated, that they were reluctant to surrender anything under this decision. We submit that this disclaimer has not been filed without unreasonable neglect and delay, and we submit further that, by their so-called disclaimer they have yielded nothing, therefore the disclaimer should be considered as not having been filed at all.

(Recess.)

The Court: Well, gentlemen, I need not say to counsel, of
2264 course, that while the court is presumed to know all law, there is some patent law with which it is not familiar. As a matter of fact this is the second seriously contested patent case that has been tried in this court in five years, my present incumbency; and of course there is a great body of patent law with which I am not familiar. When you were stating what was to be proven in this case, why it certainly seemed to me it was not within the language of that statute, and turning back to the 15th Howard, it seems to me, that they had found it to be within the statute largely from construction—more than from the necessities of the case.

Even within the Morse-O'Reilly case they hold that Morse had tried to cover all future inventions of machinery which by means of the electric telegraph might print at a distance, which seems to me to be a different thing than what is involved in this case. The statute says, claiming something that had theretofore been discovered, and that is not what would seem to me to be this case. However, the plaintiff himself seems to think that it is, and of course the court is not inclined to quarrel with their attitude in that matter, and undoubedly since the O'Reilly case a large body of law by decisions has firmly established the principle of this.

This patent in the Hyde suit seems to have been held invalid as to claims 9, 10 and 11, and the court in so declaring declared that the patent must be confined to the results obtained by the use of oil within the proportion- often described in the testimony and in
2265 the patent—which we have called the critical proportions, a fraction of one per cent. of oil to the ore. Claims 9, 10 and 11 in the patent run higher than the critical proportion of oil, a fraction of one per cent., and do not define the quantity in that way, but speak of it as using a small quantity of oil.

Now, the court having held those invalid, and apparently they being within the disclaimer statute, the plaintiff has filed a certified copy of his disclaimer, wherein he says:

"Does hereby disclaim from claims 9, 10 and 11 * * * any process of concentrating powdered ores, excepting where the results obtained are the results obtained by the use of oil in a quantity amounting to a fraction of one per cent. on the ore."

The court does not understand how the use of any other process is to be dealt with than that set out in this patent, and that part of it defined in 9, 10 and 11 or any other results other than that arrived at by the use of the process of the patent—oil, and in some acid, heat in others, and agitation in others, for the purpose of securing the froth. If, as the cases seem to hold, a claim which is in part ambiguous, as I say this is, that comes within the disclaimer statute, the court is of the opinion that the disclaimer in this part would be sufficient, for this reason he has to disclaim the excess over and above what he has invented; he has to make his patent to that extent specific and definite and free from ambiguity. These claims, 9, 10 and 11, as they now stand, have embodied within them and
2266 include within them a portion of the process which is called the use of a fraction of one per cent. of the oil with the ore. That is included within it—I see no reason why he cannot exclude or except that to which he has a right and that which is included. The language as it now stands in 9, 10 and 11 will permit him to use a fraction of one per cent. of oil in the operation of his process, and it might be construed—and this I take it is its vice—according to the decision of the Supreme Court as permitting a percentage of oil above one per cent. Excluding, as he does, all except a fraction of one per cent. of oil, he retains simply that to which he is entitled by the specifications and the other claims of patent; they are specifically set out therein. I know of nothing in the cases read which would require him to give up this portion of the claim, for it is a part of the claim. The law does not seem to require that, that an entire claim shall be abandoned, but only an excess of that which is held to be valid, in accordance with the other terms and specifications and claims of the patent.

In referring to the time of the filing, the statute fixed no time, other than to say that it shall not affect any pending suit only insofar as the question of unreasonable neglect and delay are concerned. The court would be very loath to hold, regardless of the right to apply for a rehearing in the Supreme Court, that some 100 days after the decision, or a little more—perhaps 110—and something like 75 after the mandate came down—that such a delay in a case of this kind, a patent of this nature, would involve unreasonable neglect and delay. Of course I take it in patent law—I think
2267 I can venture that far—that the law is not thinking solely and only of the possibility of damage to the litigating party, the defendant here—but also of the rights of the public, in constructively insisting that there shall be no unreasonable delay or neglect in making a disclaimer. The court can not see that there has

been any unreasonable neglect or delay here, and the court will so hold.

The court will say further at this time that of course both parties are here prepared to try this case, and the court intends that you shall try it, and be permitted to try it, on the merits. Many of the court's rulings may be more or less tentative. If there is shown reason in the final argument to change its ruling on the law, the court will do so. Of course it will not take anyone by surprise nor operate as an injury to either party, not having had the ruling made exactly at the time that it is called for. So the court will not hesitate to change its views of the law.

The objections to the admission of this disclaimer are overruled.

The defendant asked and was allowed an exception.

Mr. Williams: I don't know that I made it quite clear that in offering the record in the Hyde case in evidence I included the decrees that have been entered therein since the time when that record was first offered in evidence in this suit, including the final decree which was entered today. I include them and offer them in evidence.

2268 Now, there are certain depositions which were taken in 1914 and which have been on file in this court for some three years or so. Those are the depositions of Hugh N. Line, Ernest O. Jacobson, and Charles Frederick Chandler. Those depositions are now offered in evidence.

In connection with the taking of those depositions, certain articles were marked for identification. They are described in the depositions. I regret that I have not those articles here physically present, but they were the seal of the car, the number of the car, a bag and a bottle of concentrates, and they will be in my physical possession about Wednesday morning, and I merely wish now to offer them in evidence as described in the depositions, and will actually produce them later if there is no objection.

Mr. Kremer: They are all the articles that were marked for identification?

Mr. Williams: Yes, as described in the deposition

Mr. Kremer: I don't recall whether the record shows any objection to the introduction of these articles or not; if so, you may introduce them now and we will reserve the right to renew the objections to the court when they are produced, provided there were any objections made at the time.

The Court: Were they introduced in evidence?

Mr. Williams: They were marked for identification, but not introduced.

2269 The Court: You may renew the objections when they are produced.

Mr. Kremer: Yes, if there were any objections noted at the time.

Mr. Williams: Counsel for the defendant and myself have agreed to make a stipulation as to the infringement. Mr. Scott pleads that he has not had time to state the exact terms of that stipulation, and I can not now put it in evidence, but we have agreed upon a stipu-

lation which will describe sufficiently the operations of the defendant, to make it unnecessary for us to produce any further proof on the subject of the acts, which we charge to be infringements. We have one other subject as part of our prima facie case, which will receive the attention of Judge Garrison.

Mr. Garrison: If your honor please, we have served on counsel for the defendant a notice and a supplementary notice, to produce, and before proceeding with our oral testimony I desire to have the response of counsel for the defendant to the various items in the notice to produce and in the supplemental notice. The first item is, "any and all agreements, contracts, written undertakings, or written memoranda between James M. Hyde and the Butte & Superior Mining Company, by whatever name said company was known, or any one who was acting or purporting to act for it from January 1st, 1911, to date, or if they have not the originals of any such, then copies of the same. What is the response to that question?

Mr. Kremer: The notice was served upon me personally this morning, if your honor please. I delivered the copy that
2270 was served upon me to Mr. Bruce, and a search is now being made to see what, if anything, we have. Are you going to proceed down with your list of items?

Mr. Garrison: Yes, my intention was to proceed down with my list of items and get your response to each, unless you can make a comprehensive response, and save time.

Mr. Kremer: I might do that. In so far as the documents and matters referred to are concerned, the same statement applies, that we are making a search for them.

The Court: It was served on you this morning?

Mr. Garrison: That is perfectly reasonable.

Mr. Kremer: I think that the general response will suffice. As to the portion of the subpœna duces tecum that is directed to me personally, I would say as to that——

Mr. Garrison: I have not spoken about the subpœna duces tecum; I am speaking about the notice to produce.

Mr. Kremer: Well, it is the same thing.

Mr. Garrison: I ask you to respond to the notice to produce.

Mr. Kremer: That is what I am doing. The part that applies to correspondence by counsel, I may as well state to you now as at any other time, that, as far as the correspondence of counsel is concerned, under the rule of privilege and not being relieved by my client, it naturally follows that I would decline to produce any correspondence of a professional character with reference to my client's case.

2271 Mr. Garrison: Do I understand that as far as the notice to produce is concerned, your response to that part of it which refers to correspondence between Hyde and the officials of the company is that you have not yet had time to make such search as will enable you to make a proper response?

Mr. Kremer: Exactly.

Mr. Garrison: As far as that goes, we cannot go on until they have made search and responded, because we cannot produce oral evi-

dence as to these documents until they have failed to produce the originals.

With respect to the item concerning the correspondence to which Mr. Kremer referred, the request as to that is in the supplemental notice, and reads as follows: "All letters and copies of letters from the officers, employes, managers, superintendents, counsel or attorneys for the company to the attorneys or counsel for James M. Hyde, in Minerals Separation, Limited, against Hyde, or to Kremer, Sanders & Kremer, attorneys or solicitors for Hyde, or to J. Bruce Kremer or to Thomas F. Sheridan or Walter A. Scott, or to Sheridan, Wilkinson, Richmond & Scott, or to Sheridan, Wilkinson & Scott, counsel for Hyde, respecting or referring in any way or in any part therein to the conduct or management or control or direction, or continuance or discontinuance, or the method or means of continuance of the defense of said Hyde therein, and all letters and copies of all letters from said attorneys for Hyde or from said counsel for Hyde, or any of them, to the company or to any
2272 of its officers, attorneys, counsel or employes, respecting or relating in any way or in any part to the conduct or management or control or direction of continuance or discontinuance or the methods or means of continuance of the defense of said Hyde in said case."

Now, we are not asking for any confidential communications between Hyde and his counsel; we are asking for communications between the Butte & Superior Mining Company and counsel for Hyde. Now unless Mr. Kremer is making a response in confession and avoidance, I cannot understand the nature and propriety of his response. He says, "You have called upon us to produce correspondence between the Butte & Superior Mining Co., which was not my client in the Hyde suit, and Hyde or counsel for Hyde, and I refused to respond to that because of the doctrine of privilege." The doctrine of privilege can only be urged where a relation of counsel and client exists. Now, if Mr. Kremer will admit now upon the record that he and Mr. Scott and these other gentlemen represented the Butte & Superior Mining Company in the Hyde case, then of course it will be a matter protected by the doctrine of privilege under the familiar application of that doctrine; but if they were representing Hyde and not representing the Butte & Superior Mining Company in that suit, then correspondence between the Butte & Superior Mining Company and them as counsel for Hyde certainly is not protected by the doctrine of privilege—by any doctrine of privilege that I have ever heard of in any court in the land. I therefore insist that I am entitled to it.

2273 Mr. Kremer: I think that I can answer that quite generally. I thought you were directing your remarks to the Hyde matter. We represented James M. Hyde in that case, but I am quite sure that I can respond now by saying that there is no correspondence between ourselves as to the conduct of that case, directed to the Butte & Superior Copper Co. Limited. If there is, why we will search for it and examine it, and if we think it is proper matter

under your subpœna, we will submit it to the court subject to any objection we may have.

Mr. Garrison: That removes the misunderstanding. We are not calling, of course——

Mr. Kremer: I promise subject to that——

Mr. Garrison: You admit there can not be any privilege under this question?

Mr. Kremer: As far as Mr. Hyde is concerned, I will state that, while I don't think there is anything important, yet, if it was only as to the color of someone's hair and it transpired during that employment, I don't think that I should testify to it or divulge it except by the permission of Mr. Hyde; but I do not deem it of any great importance except to myself as a practitioner.

Mr. Sheridan: As far as we are concerned, your honor, I refer to Mr. Scott and myself—we got this notice this morning, and we are 2,000 miles or 1,500 miles away from our office, and I don't see how they expected us to comply with it unless they want to delay the case long enough for us to go back to Chicago and search the files; no clerk can do it. They could not tell the difference
2274 between matters proper under the subpœna and improper. I don't see why they could not have notified us two or three or four weeks ago. They knew long enough in advance what they would want.

Mr. Garrison: We were misled by the testimony given by Hyde as to the relationship existing between him and this company, until our good fortune opened our eyes as to the truth.

The Court: You are not asking the impossible?

Mr. Garrison: No, sir, certainly not.

The Court: You cannot ask the court to sit here and wait until these matters are supplied to you, very long?

Mr. Garrison: No, sir, we will not; if these gentlemen will respond with respect to what is here within their own knowledge, and that is ample, we will waive the rest.

The Court: They say they are making a search, and I suppose they will do so.

Mr. Garrison: Yes, sir.

Mr. Kremer: Furthermore, in order that Judge Garrison may not further misunderstand, under the issues in this case it will be our position that any and all of the documents called for that are in that notice or in that subpœna duces tecum, are wholly incompetent, irrelevant and immaterial for any purpose, there being no issue in this case that would justify their introduction, if they did in fact exist, and for the further reason that by proceeding against this defendant in the manner in which they have, instead of proceeding in the original Hyde case by supplemental proceedings, they
2275 are estopped and now disbarred from raising any such contention as that which they seemingly are attempting to raise here, by a privity between Hyde and the Butte & Superior, the allegations of the bill not being sufficient to justify such a proceeding. And further under the allegations of the bill the issues in this case, the Butte & Superior Company could not, taking the allegations of

the bill with reference to Hyde and the Butte & Superior as true for the sake of the argument, they could not raise an issue that would prevent the Butte & Superior from having its day in court. The same question was raised and argued somewhat before this court, as I recall, upon one of the applications for an increase of bond. The statement was made there that this case was res adjudicata as to the Butte & Superior, and if I recall your honor's position——

The Court: I don't remember it that way. I think it was at the time the injunction was applied for.

Mr. Garrison: Yes, it was on an application for injunction.

Mr. Kremer: Well, it was in one of those proceedings, I don't remember just which one.

Mr. Garrison: The court said there were not sufficient facts before him then to reach that conclusion.

Mr. Kremer: But there was sufficient before the court upon the application for the increase of the bond; but that was several years ago.

The Court: Well, I suppose that your objection may be made when they offer their defense in that respect.

2276 Mr. Garrison: That is the only other evidence that we have, stipulation taking the place of the evidence as to the matter of the infringement, and then we are prepared to close.

The Court: The stipulation as to the alleged infringement, and about the matter being res adjudicata as it is.

Mr. Garrison: Yes, sir, with that exception we are prepared to close.

The Court: Is that pleaded?

Mr. Williams: Yes, it is pleaded without question.

Mr. Kremer: There is a question, and it is a question of law, too. There is no allegation seeking to show that it is res adjudicata in this. That will appear from the face of the bill itself. They allege in this bill that the Butte & Superior Copper Company, Limited, confederated with Hyde, but there is no basis there for showing that the Butte & Superior was a party to that suit. The bill speaks for itself.

Mr. Williams: Read clause 8.

Mr. Kremer: Yes, I will read clause 8. "On information and belief, that the defendant herein confederated with the said James M. Hyde in the acts of infringement complained of in the said suit against the said James M. Hyde and was an actual defendant therein, and conducted the defense of said James M. Hyde for his services in assisting in the defense of the said suit; that the acts decreed in the said suit to be acts of infringement were carried on under certain letters patent issued to said James M. Hyde on April 2,

2277 1912, No. 1,022,085, and that since the commencement of said suit the said James M. Hyde assigned to the defendant herein all of the right, title and interest of the said James M. Hyde in, to and under his said letters patent No. 1,022,085, for, to and in the County of Silver Bow and State of Montana, that the acts decreed in the said suit to be acts of infringement were carried on in the mill of the defendant herein and by the employes of the defendant herein and have been continued by the defendant herein in the

identical apparatus used by the said James M. Hyde; and that this defendant is a joint tort feasor with the said James M. Hyde in the acts thus decreed to be infringements and is in privity with the same James M. Hyde and is bound by the said decree against the said James M. Hyde."

That is all a matter of conclusion. This company could, from the standpoint of law, could have financed Mr. Hyde. That would not have made them a party to this suit. And their bare statement that it was a party defendant was insufficient in law. So, under the very allegations, this bill is framed upon an infringement, not by Hyde, but an infringement, as is testified to in this case, by Mr. Line and Mr. Jacobsen, and Dr. Chandler, and will be supplemented by the proof that you will offer.

And it is the act of infringement that has made the basis of this complaint.

Mr. Williams: No, every action.

Mr. Kremer: You cannot cover that by a general conclusion that somebody is a defendant in this case.

2278 Mr. Williams: What about conducting the defense of said suit?

Mr. Kremer: Absolutely insufficient.

Mr. Williams: And paying for the expenses thereof.

Mr. Kremer: You have a perfect right to pay the expenses of any litigation you see fit.

Mr. Williams: And conducting the defense?

Mr. Kremer: The only thing you could possibly come in contact with would be an act of champerty in maintenance.

The Court: Of course the question would be whether he was your servant throughout and whether you were defending him as your servant and thus defending yourselves at the same time.

Mr. Kremer: There is no allegation that Mr. Hyde was our servant.

Mr. Garrison: I don't understand your honor is going to pass upon this until it is raised in the proper manner.

Mr. Kremer: Then we will raise it upon the demand here set forth and the statement of counsel that they are ready to proceed, ready to close their case about the presentation of this proof on those documents that they now demand. We then ask that the case proceed for the defendant for the reason that upon their own statement it is incompetent, irrelevant and immaterial and has no bearing upon the issues in this case and is not properly within the pleadings and the issues here raised. I think now it places it properly before the court.

2279 The Court: Well, I will overrule your objection at this time, or your motion, whichever you make it, but when we come to offer this, if you want to be heard further, I will hear you.

Mr. Kremer: Then we will renew the objection whenever the documents are presented.

The Court: Certainly. Then you are not prepared to proceed further today?

Mr. Williams: Very sorry.

The Court: Will this stipulation be ready in the morning?

Mr. Scott: I think, your honor, they will be ready in the morning. I want to verify the figures.

Mr. Garrison: Do I understand from the other side that insofar as your own records here are concerned, the records of the company and your own personal records you will be able to respond by tomorrow morning?

Mr. Kremer: As far as my own personal records are concerned I can respond now.

Mr. Garrison: I want it upon the record at the proper time.

Mr. Kremer: You can have it upon the record now that there is nothing, so far as I am concerned.

Mr. Garrison: I shall ask it all over again. All I want to know now is whether you can answer tomorrow morning?

Mr. Kremer: Wait until tomorrow morning.

Mr. Garrison: I was trying to ascertain the fact.

The Court: Well, they must have such time as is reasonably necessary to respond.

2280 Mr. Garrison: We have endeavored to ascertain what they propose to do.

The Court: They will try to be prepared in the morning, I suppose, or the next morning. We will now suspend until tomorrow morning at 10:00 o'clock.

Whereupon an adjournment was taken until Tuesday, April 17, 1917, at 10:00 o'clock a. m.

Tuesday, April 17th, 1917.

Mr. Garrison: If your honor please, we are ready now to receive the response of the solicitors for the defendant to our notice to produce and to our supplemental notice to produce.

The Court: Gentlemen, are you prepared to respond this morning?

Mr. Kremer: I am.

Mr. Garrison: The first item is, any and all agreements, contracts, written undertakings or written memoranda between James M. Hyde and Butte & Superior Mining Company, by whatever name said company was known, or anyone in its behalf or purporting to act for it, from January 1st, 1911, to date, or if you have not the originals of any such, then copies of the same.

Mr. Kremer: We have a copy of a contract. I will furnish you not only a copy of the contract with Mr. Hyde, but, although it possibly is not called for there, yet this is a modification of that

2281 contract, and I will give you the entire agreement. I suppose you wish to offer them. If so, then we will object. Perhaps you would like to look at them first.

Mr. Garrison: I would.

The Court: Have you quite a number of documents that are called for?

Mr. Kremer: I think the document which Judge Garrison has

now is about all we will produce. The other correspondence that we have is of the character calling for a certain size of this or that piece of machinery. There is also the matter of the expense of this Hyde litigation.

Mr. Garrison: Perhaps we had better go ahead with our notice, and if you will furnish them we will take them all and look at them.

The Court: Of course I do not care to sit here and watch you read. I will give you time to look over them. If you have any more that you intend to produce you might produce them. Have you others?

Mr. Garrison: Yes, sir, I will read the next item.

"Any and all letters from James M. Hyde to the Butte & Superior Mining Company (by whatever name said company was known) or to anyone in its behalf or purporting to act for it, from January 1st, 1911, to date, or if you have not the originals thereof, then copies of the same."

Mr. Kremer: Judge Garrison, in that connection, you would be compelled, I think, to make that more specific. You are not entitled to all correspondence. If your request is for all correspond-

2282 ence as to any particular feature, perhaps we can find it, and we will assist you to our utmost endeavor; but it is too broad as it stands. This is not a fishing expedition. We are perfectly willing to produce anything that we have that is germane to this case.

Mr. Garrison: We think that everything that James M. Hyde wrote or received commencing January 1st, 1911, about the time he left our employ and entered the employ of the defendant, that has to do with his employment or with the flotation process or with our patent or with his alleged patent is relevant to this suit.

Mr. Kremer: Even if he installed a gallows frame for us?

Mr. Garrison: If it was in your employment.

Mr. Kremer: He was never in their employment, as far as that is concerned. I don't think you have a right to ask for everything this way. This is not a proceeding in search and seizure.

The Court: Of course it is understood to apply solely to their relations together.

Mr. Garrison: Anything applying to their business relations.

The Court: As to the matter of this concentration business under this process; it would be limited to that. Of course the notice is broader than that.

Mr. Kremer: Yes, sir; it calls for everything.

Mr. Garrison: It is broader than that because we did not know what shape the matter might assume; if they admit that they had correspondence with him directed to this matter——

2283 The Court: That is all the defendant will be required to produce, letters passing between Hyde and the Butte & Superior Mining Company, by whatever name it was known, relating to their operations in the concentrator and in connection with this flotation process. Are you prepared to furnish any such now?

Mr. Kremer: Yes, sir, in a moment.

Mr. Garrison: The next item is, any and all copies of letters from

the Butte & Superior Mining Company (by whatever name said company was known) or by anyone on its behalf or purporting to act for it, to James M. Hyde, from January 1st, 1911, to date.

The Court: That is, relating of course to the process and the suit that is pending.

Mr. Kremer: We will produce them.

Mr. Garrison: Any and all pay rolls of the Butte & Superior Mining Company (by whatever name said company was known) on which the name of James M. Hyde appears, from January 1st, 1911, to date, and if you have not the originals, then copies thereof.

Mr. Kremer: There are none.

Mr. Garrison: Any and all canceled checks of the Butte & Superior Mining Company (by whatever name said company was known) on which the name of James M. Hyde appears, from January 1st, 1911, to date.

Mr. Kremer: I have three, I believe, that I will give you.

Mr. Garrison: The check books of the Butte & Superior Mining Company (by whatever name said company was known) or
2284 whoever paid out the funds for and on behalf of the said company to James M. Hyde containing the stubs of the checks on which the name of James M. Hyde appears, from January 1st, 1911, to date.

Mr. Kremer: We did not use check books; we used vouchers, and the voucher will give you the same information.

Mr. Garrison: The books of account of the Butte & Superior Mining Company (by whatever name said company was known) from January 1st, 1911, showing the account or accounts between Butte & Superior Mining Company (by whatever name said company was known) and James M. Hyde, or if there is no separate account or accounts of that character, then the books showing any and all payments to said James M. Hyde from January 1st, 1911, to date.

Mr. Kremer: Those books are in New York, but I think from the data we will furnish you, that that will be covered—all that possibly might appear in the books.

Mr. Garrison: Particularly a copy or draft of a memorandum of agreement, whether the same be signed by both or one or neither of said parties, between Butte & Superior Mining Company (by whatever name said company was known) or anyone acting on its behalf or purporting so to do, and James M. Hyde, in the year 1911 relating to the erection of a flotation plant at Basin, Montana, and the arrangement with James M. Hyde concerning the same.

Mr. Kremer: That is the one that I furnished to you.

Mr. Garrison: Oh, yes. Then the next is, all letters from
2285 officials, employes, managers or superintendents to the company or to any officer or attorney of the company regarding the matter of securing the services of James M. Hyde, or securing the benefit of the knowledge of James M. Hyde regarding the flotation process of ore concentration, and any and all letters from the company to any of its officers, employes, attorneys, managers or superintendents relating to the matter of securing the services of

James M. Hyde or the benefit of the knowledge of James M. Hyde respecting the flotation process of ore concentration.

All letters or copies of all letters from officers, employes, managers, superintendents, counsel or attorneys of the company, to the attorneys or counsel for James M. Hyde, in Minerals Separation, Limited, against Hyde, or to Kremer, Sanders & Kremer, attorneys or solicitors for Hyde therein, or to J. Bruce Kremer or to Thomas F. Sheridan or to Walter A. Scott, or to Sheridan, Wilkinson, Richmond & Scott, or to Sheridan, Wilkinson & Scott, of counsel for Hyde therein, respecting or relating in any way or in any part to the conduct or management or control or direction or continuance or discontinuance or the methods or means of continuance of the defense of said Hyde therein.

Mr. Kremer: There is nothing but the correspondence that passed between the counsel for Mr. Hyde, that is, between Mr. Sheridan and Mr. Scott and myself, in the preparation and conduct of the Hyde case, which of course is privileged and I don't think I ought to produce that.

Mr. Garrison: It is your response that there is no correspondence with the managers of the Butte & Superior Company or the attorneys for the Butte & Superior Company, and the attorneys representing Hyde, on the matter; is that your response?

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Mr. Kremer: Yes, in this manner—I want to qualify it. Of course you understand that I am now and have been since its organization, the attorney for the Butte & Superior Mining Company, but my correspondence with Mr. Hyde and with Mr. Sheridan in connection with Mr. Hyde and the Hyde case was in the case in which I represented Mr. Hyde. So don't misunderstand me.

Mr. Garrison: I think we are entitled to the correspondence from Mr. Kremer, the attorney for the Butte & Superior Mining Company, with the attorneys appearing for Hyde; that can not be privileged.

Mr. Kremer: There is no correspondence of that nature. As attorney for Mr. Hyde, I corresponded with my co-counsel, of course.

Mr. Garrison: I realize that that is privileged and I do not call for it. I do call for any correspondence with Mr. Kremer, who says he was, from the beginning of the company, the attorney for the Butte & Superior Mining Company, with whoever appeared as counsel for Mr. Hyde in the Hyde suit.

The Court: You say there is none such?

Mr. Kremer: No, there is none, but as counsel for Mr. Hyde I had a great deal of correspondence with Mr. Scott and Mr. Sheridan, my co-counsel. I don't know of a single instance in the Hyde case where I wrote as attorney for the Butte & Superior; but afterwards, you understand, Judge Garrison, with the attorneys of the Butte & Superior there has been a great volume of correspondence between us in connection with that suit.

2287

Mr. Garrison: Your honor sees my difficulty. I realize, of course, that I have no right to and I do not call for any correspondence between counsel representing the defendant Hyde; but I am entitled to all correspondence in which the writer was representing the Butte

& Superior, and not representing Hyde, even though he might be the same person.

Mr. Kremer: Well, there is nothing of that sort.

The Court: That might be, but he has answered that there is none such.

Mr. Garrison: Every time he answers he qualifies it, and that makes it difficult.

Mr. Kremer: I do not want to mislead you, and yet I want to make a truthful statement, so I must qualify in order to state it correctly; I cannot answer yes or no to such a question.

The Court: Yes, that is true, and you must take his statement as qualified.

Mr. Garrison: I want to understand if there is a dividing line, on one side of which I am entitled, and on the other side I am not entitled, and it is difficult to draw the line, because of the dual capacity in which Mr. Kremer served these two clients.

The Court: There is a sort of twilight zone there.

Mr. Kremer: To a certain extent, but there was a certain condition there that I am going to state later, which I think will clarify the situation, and then the way will be just as wide as across the street.

2288 Mr. Garrison: I want to say this before this feature of the case is departed from: if it be the fact that the Butte & Superior Mining Company in any way directed the defense or participated in the defense of the Hyde suit, it is inconceivable that it did so without the action of someone on behalf of the Butte & Superior Company. It is possible, of course, that that participation and direction on behalf of the Butte & Superior Company was done by oral conversation, by word of mouth. If it were not, then our call is made for whatever writings there may be, and if the response of Mr. Kremer covers that, viz., that they have no copies or originals of any writing from or on behalf of the Butte & Superior Mining Company to Hyde or anyone representing Hyde with respect to the conduct of the Hyde suit, of course I will accept that, but I want it perfectly clearly understood that that is what I am asking for, and that is the thing to which I am entitled to have a response.

Mr. Kremer: And that is to what I have responded and in this connection your honor will bear in mind that the record shows from the statement of Mr. Hyde, in answer to a question propounded by Mr. Williams, Mr. Hyde stated that he was paying for the defense of the suit by money furnished by the Butte & Superior Company. And the only thing, Judge Garrison, that would mark any connection at all would be that in two instances I believe a bill from Sheridan, Wilkinson & Scott and Richmond for some number of dollars—not a great deal—several thousand, all told, was delivered to me.

2289 I O. K.'d it and passed it on to the Butte & Superior. With that exception I can answer your question that there was no common representation. I trust that I make myself clear.

Mr. Garrison: No, you do not make yourself clear to this extent: That, obviously, whatever the Butte & Superior did with respect to the contributing or directing of the payment of expenses, or what

not, of the Hyde suit must be done by some one on behalf of the Butte & Superior Company. Now, if the engagement to do that was by word of mouth, then of course your response would be that there was no writing. On the other hand, if that participation was evidenced by a writing, then I have called for that writing and I am entitled to it.

Mr. Kremer: There was no writing except as I say, "I have received your bill for so many dollars; I have approved it and passed it on for payment." I will furnish you that if you wish it. Aside from that, there is nothing.

Mr. Garrison: Then their payment was not as a result of any undertaking or agreement.

The Court: In writing, I assume? He is not under oath.

Mr. Kremer: Not that I know of.

Mr. Garrison: Yes, I am asking for writing.

Mr. Kremer: No, nothing. I am trying to make my statements just as I would make them if I were under oath.

Mr. Garrison: Then I am saying that the conclusion of this is that there is no writing by which the Butte & Superior undertook to do anything, financial or otherwise, with respect to the Hyde suit.

2290 Mr. Kremer: I think that statement is quite correct. So far as I know, I know of no agreement or exchange of letters which specify the manner or the amount of what the Butte & Superior shall pay, and I have no such correspondence except which you will find in these copies that I am going to furnish you. There are statements in there with respect to the expenses of this litigation; but you are now asking for correspondence between counsel.

Mr. Garrison: Or between the companies.

Mr. Kremer: I have already told you I would furnish you with a part of that.

Mr. Garrison: Perhaps the matter better rest until we see what they do furnish us, and then I can take advantage of your honor's suggestion to amend my notice if there is something I have not covered, or renew my notice if I find there is something I think I am entitled to from them.

Mr. Kremer: We are perfectly willing. We are not trying to avoid the furnishing of anything we have except I do not want to place myself in the position of yielding up on behalf of a client something that I have no right, professionally, to yield.

Mr. Garrison: The last item is: "All letters or copies of letters from said attorneys for Hyde or from said counsel for Hyde or any of them to the Company or any of its officers, attorneys, counsel or employes respecting or relating in any way or in any part to the conduct or management or control or direction or continuance or discontinuance of the methods or means of continuance of the defense of said Hyde in said case."

2291 Mr. Kremer: The same situation would exist there. The company had nothing to do with the initiation of the litigation nor its prosecution.

Mr. Garrison: Now, may we have a little recess to look over these papers?

Mr. Kremer: I think the shortest way to do this is to give them all the papers.

The Court: What will this examination involve? The morning's work?

Mr. Kremer: I wouldn't think it ought to take them very long.

Mr. Garrison: I should not think so. I should not think it would take us the morning.

The Court: We will suspend until eleven o'clock or such time as I am advised you are ready to proceed.

(Whereupon a recess was taken.)

Mr. Garrison: With permission of the court, I desire to offer in evidence a copy furnished me by the defendant of an agreement made on the 22nd day of July, 1911, between the Butte & Superior Copper Company, Limited, and James M. Hyde. I understand it will be conceded that the Butte & Superior Company, Limited, was the former name of the present defendant.

Mr. Kremer: It was, yes. Are you offering it?

Mr. Garrison: I do offer it, yes, sir.

Mr. Kremer: To which offer the defendant objects for the reason that the document is incompetent, irrelevant and immaterial; that under the allegations of this case the proof would not be admissible for any purpose and for the further reason that there is no sufficient basis for proof under a contention of res adjudicata;
2292 for the further reason that the document upon its face shows that it is a contract by and between the defendant company and James M. Hyde acting as an independent engineer, an independent contractor, for compensation at a contract price, which is of such a character as shown by the document, to preclude the contention that Mr. Hyde was an employe or an agent of the defendant company; for the further reason that it has not been contended and it is not now contended by counsel for the plaintiff that the Butte & Superior Company is bound by the decree alleged to have been entered in the so-called Hyde case; and, the foregoing being true, it is apparent for any one of the several reasons for objection interposed that the contract is incompetent, irrelevant and immaterial for the purpose of proving any contention of res adjudicata or estoppel herein; and for the additional and further reason that no foundation has been laid that would permit of the introduction of testimony seeking to establish res adjudicata as against this defendant.

Mr. Garrison: Does your honor want to hear me on that?

The Court: Do you want to argue it?

Mr. Kremer: If we are going to reargue hereafter all of the questions, I don't want to waive the ruling now upon objection, but I take it from my past experience that we will have to reargue all of these over again.

The Court: I take it so. As a matter of course, if anything is not obviously incompetent, irrelevant nor immaterial the court
2293 will admit it for the sake of the record and for the sake of a decision in a higher court, where it is to be assumed such a case will go. If we exclude anything, or have made any mistake in

connection with the admission of any evidence, the appellate court may have to send it back for retrial, but if it is in the record they can dispose of the case.

Mr. Kremer: I assumed your honor's ruling would be pro forma.

The Court: As far as the pleadings are concerned, I don't understand that they would be obliged to plead it at all, although they have pleaded it probably after a fashion that might be criticised. It is the ordinary question relating to the title to a patent, a valid patent that they claim is infringed by the defendant. Now, the defendant sets up that the patent is not valid. That of itself, without pleading any further adjudication, would permit the introduction by the plaintiff of a former adjudication to estop the defendant from interposing that defense. I am speaking now of the ordinary rules of pleading and I do not suppose there is anything peculiar to patent litigation as to the pleading. While a rule exists to plead former adjudication in patent proceeding I take it it is largely done to satisfy the old equity rule in cases where they are seeking a preliminary injunction. If A has quieted his title against B to a piece of property and afterwards sues B in ejectment, he simply alleges that he is the owner, does not allege that he has secured a prior adjudication of title against B. If B attacks his title in any system of pleadings or replication, then it would be necessary for A to plead
2294 the estoppel in the replication. No replication is necessary in equity proceedings in the Federal Court. Hence he can introduce it in evidence without having pleaded it. So I take it in this case as it is to estop you from the defense of lack of novelty that you plead, and of course the plaintiff introduces it as part of its case in chief to obviate the necessity, if he makes his claim good, of the court first hearing the defense of the defendant, and afterwards taking note of the estoppel. The objection is partly based upon the assertion that there is no claim that the defendant is bound by the Hyde decree. I don't understand that that is the attitude of the plaintiff.

Mr. Garrison: Just the contrary.

The Court: If it was, of course, as far as estoppel is concerned it would be immaterial.

Mr. Kremer: Do I understand that it is your contention, Judge Garrison, that the Butte & Superior Mining Company is bound by the decree in the Hyde case and that the decree in the Hyde case settles the controversy between the parties plaintiff and the defendant Butte & Superior Mining Company?

Mr. Garrison: Does the court desire me to answer that now?

The Court: Why, you may.

Mr. Garrison: I do not want to take the time of the court unless the court wants me to.

The Court: You may answer it at this time, to make your position clear to counsel.

Mr. Garrison: Our contention is that Hyde had such a relationship to the defendant company that when they undertook the
2295 conduct of the defense of the Hyde suit, the findings with respect to the validity of the patent and what constituted

infringement in the Hyde suit estopped them from re-litigating these questions in this suit. We do not, of course, contend that the decree binds them in the sense that, based on that decree, we could enjoin them or based on that decree we could recover damages, profits or costs from them. We do contend that they are estopped by reason of their conduct from re-litigating in this suit that which they elected in the conduct of the Hyde suit to be caused to be litigated and settled therein as to the validity and character of an action which constituted an infringement of a valid patent.

The Court: The court so understands.

Mr. Kremer: They are taking the position then, as I understand it, that we are bound in part by the Hyde decree.

The Court: The court understands it so. That is to say you are debarred and estopped from further litigating the validity of the patent.

Mr. Kremer: Then the res adjudicata only applies to a part.

The Court: Well, that might be a legal proposition. At this time the court of course will overrule the objection and the documents will be received.

The contract admitted in evidence and marked Plaintiff's Exhibit 1.

Mr. Garrison: I now offer in evidence memorandum of agreement, a copy of which has been furnished us by the defendant dated the 26th day of October, 1911, between James M. Hyde and
2286 Butte & Superior Company, Limited, by A. B. Wolvin, president.

The Court: Is this another agreement?

Mr. Garrison: This is a modification, sir, of the exhibit 1.

Mr. Kremer: To which the defendant objects for the reasons hereinbefore set forth, and for the reason that it is incompetent, irrelevant and immaterial for any purpose whatsoever.

The Court: The objection will be overruled.

Mr. Kremer: Exception.

Document admitted in evidence and marked Plaintiff's Exhibit 2.

Mr. Garrison: I now offer in evidence a copy of letter dated September 21st, 1911, addressed to James M. Hyde, Basin, Montana, unsigned, with typewritten initials indicating it to have been dictated by M. W. A., and we understand that the defendant concedes that this was Maxwell W. Atwater, the then superintendent of the defendant company.

The Court: I understand you are offering this as having been produced by the defendant upon your notice?

Mr. Garrison: Yes, sir; they were furnished us by the defendant.

Mr. Kremer: Yes, certainly we furnished them.

The Court: Well, it may be received under your original objection.

Mr. Kremer: Yes, sir; I was simply trying to ascertain if there was any additional objection. I make simply the same objection as to the last.

The Court: Objection overruled.

Defendant excepted.

2297 Letter admitted in evidence and marked Plaintiff's Exhibit 3.

(It was thereupon stipulated that the official reporter should make copies of all exhibits and that the originals should thereupon be returned to the party producing them.)

Mr. Garrison: I now offer in evidence a letter furnished by the defendant, signed James M. Hyde, addressed to J. L. Bruce, dated April 24th, 1913. I understand it is stipulated by the defendant that J. L. Bruce was at that date the manager of the defendant corporation.

Mr. Kremer: Yes, sir. We make the same objection.

The Court: Objection overruled.

Defendant excepted.

Letter of April 24th, 1913, admitted in evidence and marked Plaintiff's Exhibit 4.

Mr. Garrison: I now offer in evidence letter signed M. B. MacKelvie, president, on the paper of the Butte & Superior Copper Company, Limited, dated July 2nd, 1913, addressed to J. L. Bruce, manager Butte & Superior Mining Company, Limited, O'Rourke Estate Building, Butte, Montana.

Mr. Kremer: The same objection.

The Court: Objection overruled.

Defendant excepted.

Letter dated July 2, 1913, admitted in evidence and marked Plaintiff's Exhibit No. 5.

Mr. Garrison: I offer in evidence letter furnished us by the
2298 defendant signed James M. Hyde, dated January 5th, 1911, and over the 1911 is a pencil question mark, and under it in pencil 1912, addressed to M. W. Atwater, Butte, Montana. I understand it is conceded by the defendant that the proper date is 1912. Mr. Atwater was not here in 1911, but at that date in 1912, the defendant concedes that M. W. Atwater was the superintendent of the defendant corporation.

Mr. Kremer: The notation was put on there by us, was it?

Mr. Garrison: Oh, yes. We have not touched any of your exhibits. Mr. Hyde was not in this country in March, 1911; he was in London at our office.

Mr. Kremer: All right; it was March, 1912. I make the same objection.

The Court: Objection overruled.

Defendant excepted.

Letter dated January 5th, 1911, which should be 1912, admitted in evidence and marked Plaintiff's Exhibit 6.

Mr. Garrison: I offer in evidence a copy of letter furnished us by the defendant signed with the initials J. L. B., manager, dated May 17th, 1913, addressed to Mr. D. C. Jackling, vice president and gen-

eral manager of the Utah Copper Company, Salt Lake City, Utah. I understand it is stipulated by the defendant's attorney that the initials J. L. B. stand for J. L. Bruce, and that he was at that time the manager of the Butte & Superior Mining Company, the defendant.

2299 Mr. Kremer: Yes. We make the same objection.

Mr. Garrison: Will it be stipulated upon the record that upon the date May 17th, 1913, Mr. D. C. Jackling was vice president of the defendant company?

Mr. Kremer: I don't know whether he was on that date or not.

Mr. Williams: The records of the company will show that.

Mr. Kremer: To this letter I make the additional objection that it is incompetent, irrelevant and immaterial for any purpose whatsoever. The file furnished counsel was a file containing all of the correspondence that had transpired between any of the parties, but I will submit this letter to your honor at this time. I don't think it is relevant.

Mr. Garrison: Is it your objection that it is addressed to Mr. Jackling of the Utah Copper Company?

Mr. Kremer: That is one of the objections.

Mr. Garrison: Well, I will call Mr. Bruce.

The Court: No, you need not do that; you can make it good later on, unless you think you cannot.

Mr. Garrison: I was going to get Mr. Bruce to say that it was addressed to Mr. Jackling because he was the vice president of the defendant company.

The Court: You can establish that later, unless you say you cannot show it.

2300 Mr. Garrison: I say I can show it to the court now, I can show that Mr. Jackling was connected with the defendant company.

Mr. Kremer: And I object that it has nothing whatever to do with this case, and is incompetent, irrelevant and immaterial. There is no dispute in this case and never has been—and there is no issue as to this.

The Court: It is a circumstance in this case. Of course it does not identify the service rendered.

Mr. Garrison: They will concede that the service rendered was in the Hyde suit.

Mr. Kremer: I will further concede that the record shows, brought out by the plaintiff in this case, that Mr. Hyde had sold his rights to a certain patent, and in consideration for those rights, the expense of this litigation was being paid, so there is no controversy about that.

The Court: I know, but are they to be bound by Hyde's statement?

Mr. Kremer: Surely they are, if they bring out a matter of that sort, unless they want to refute it, but they cannot refute it by augmenting the truth of it.

The Court: I think we will let this go in; this may be one of the circumstances. I don't remember, myself, what is in the record, of course. The objection will be overruled.

Defendant excepted.

Mr. Garrison: I understand that it is conceded by counsel for the defendant that the case referred to in exhibit 7 was the case
2301 of Minerals Separation Limited against James M. Hyde, the letter being dated May 17th, 1913.

Mr. Kremer: We will endeavor to ascertain that for you, just what bill it was. We will make a note of it and look it up.

Letter dated May 17th, 1913, admitted in evidence and marked Plaintiff's Exhibit 7.

Mr. Garrison: I offer in evidence a letter furnished us by the defendant from M. B. MacKelvie dated July 28th, 1913, addressed to Mr. J. L. Bruce, Butte, Montana. I understand it is stipulated by the defendant that at that time Mr. J. L. Bruce was manager of the defendant corporation.

Mr. Kremer: We make the same objection.

The Court: Objection overruled.

Defendant excepted.

Mr. Garrison: Will you stipulate that on the 28th of July 1913, Mr. M. B. MacKelvie was the president of the defendant corporation?

Mr. Kremer: Yes.

Letter dated July 28, 1913, admitted in evidence and marked Plaintiff's Exhibit No. 7A.

Mr. Garrison: I offer in evidence letter which is referred to in the letter just offered, which enclosed letter or copy thereof is signed James M. Hyde, and is addressed to Mr. M. B. MacKelvie and is dated July 15th, 1913. I offer these two as one exhibit.

2302 Mr. Kremer: The same objection, and for the further reason that the last offer is of a typewritten copy of a letter signed by Mr. Hyde, and for that reason is not admissible. It is not identified as having been written by Mr. Hyde.

The Court: Objection overruled.

Defendant excepted.

Letter dated July 15th, 1913, admitted in evidence and marked Plaintiff's Exhibit 8.

Mr. Garrison: I now offer in evidence a letter furnished by the defendant signed F. R. Wicks, mill superintendent, addressed to Mr. S. E. Janney, manager of mills, Utah Copper Company, Salt Lake City, Utah, dated September 16th, 1913.

Mr. Kremer: This is objected to on the ground that it is incompetent, irrelevant and immaterial, and for the additional reason that it shows no connection whatsoever with Mr. Hyde or with the company, nor does it purport to connect Mr. Hyde in any way with the company or its operations by any one in authority so to do.

The Court: Is there anything in it relating to this matter?

Mr. Garrison: Oh, yes, sir.

The Court: The objection will be overruled. Of course if it should develop that it is incompetent, the court will rule it out later.

Mr. Kremer: Of course I understand that your honor holds that we may renew all these objections as to competency later if necessary?

2303 The Court: Yes.

Letter of September 16, 1913, admitted in evidence and marked Plaintiff's Exhibit 9.

Mr. Garrison: I offer in evidence letter furnished us by the defendant, signed M. B. MacKelvie, to Mr. Allen H. Rogers, care of Butte & Superior Copper Company, Limited, Butte, Montana, dated March 1st, 1913, together with an enclosure, namely a statement addressed to the auditor calling upon him to pay James M. Hyde a certain specified sum of money, under date of January 29th, 1913. I understand that it is stipulated by the defendant that at that time Mr. M. B. MacKelvie was president of the defendant corporation.

Mr. Kremer: You said this was a statement to the auditor; it is a bill.

Mr. Garrison: It is a statement to the auditor exactly as I said. It is addressed to the auditor.

Mr. Kremer: By James M. Hyde. To that we make the same objection.

The Court: Objection overruled.

Defendant excepted.

Letter of March 1st, 1913, together with voucher or bill of January 29th, 1913, admitted in evidence and marked Plaintiff's Exhibit 10.

Mr. Garrison: I offer in evidence a paper headed Butte & Superior Copper Company, Limited, Butte, Montana, March 6th, 1913, containing language as follows: "Voucher payable to James M.

2304 Hyde. $601.70. Approved for payment," and with an ink signature "C. M. Everett."

Mr. Kremer: To which we object for the reason previously stated, and for the further reason that it does not prove any issue here.

The Court: Objection overruled.

Defendant excepted.

Paper dated March 6th, 1913, admitted in evidence and marked Plaintiff's Exhibit 11.

Mr. Garrison: I now offer in evidence a voucher check of the Butte & Superior Copper Company, Limited, signed by C. M. Everett, "Special." Addressed to the First National Bank of Butte, Montana, dated March 6th, 1913, for $601.70, payable to the order of James M. Hyde, and endorsed in ink, "James M. Hyde." With various marks showing that it was paid—various cancellations of the bank.

Mr. Kremer: We make the same objection.

The Court: Objection overruled.

Defendant excepted.

Voucher dated March 6, 1913, admitted in evidence and marked Plaintiff's Exhibit No. 12.

Mr. Garrison: I offer as one exhibit papers described as follows: A typewritten paper headed "Expense account of James M. Hyde in attendance on Mill and Patent Suit, March and April, 1913," with items aggregating $325.65. A paper entitled "Audit bill, Butte & Superior Copper Company," addressed to the auditor, call-
2305 ing upon him to pay James M. Hyde that sum of money already mentioned under date April 30th, 1913. Then a paper headed "cash voucher" payable to James M. Hyde for the same sum of money, dated March 2nd, 1913.

Mr. Kremer: The same objection.

The Court: Objection overruled.

Defendant excepted.

Three papers, expense account, audit bill and cash voucher admitted in evidence and marked Plaintiff's Exhibit 13.

Whereupon an adjournment was taken until 2:00 o'clock P. M. of this day, Tuesday, April 17th, 1917.

Tuesday, April 17, 1917—2:00 p. m.

Court convened pursuant to adjournment, all parties present; whereupon the following proceedings were had:

Mr. Williams: I will now complete a few matters. This stipulation has been agreed upon and I will read it into the record. It is hereby stipulated that the concentrates which were contained in car So 15679 at Bartlesville, Oklahoma, on September 18th, 1913, referred to in the deposition of Hugh N. Line, given in behalf of plaintiff, were the concentrates produced by the defendant in its flotation plant. It is further stipulated that subsequent to January, 1912, and prior to the commencement of this suit, the defendant
2306 carried on a process of concentrating ore wherein the minerals were separated from gangue by agitating the ore in water, containing oleic acid in the proportion less than twenty pounds to the ton of ore, to form a froth, and separating the froth by flotation, and that the defendant also used heat and sulphuric acid in such process.

I now offer in evidence various articles which were identified by witnesses during the taking of the depositions and were marked for identification by the examiner at the time of taking these depositions.

The first article marked for identification seal of car is offered in evidence as plaintiff's exhibit 14.

Mr. Kremer: I don't think I shall object to any of these.

Mr. Williams: You have stipulated that this car contained your concentrates. This is the seal of the car.

Mr. Kremer: To save time, I don't think there is any objection to any of these.

Seal admitted in evidence and marked Plaintiff's Exhibit 14.

Mr. Williams: This slip of paper marked for identification, "Memorandum of number of car" offered in evidence as plaintiff's exhibit 15.

Memorandum admitted in evidence and marked Plaintiff's Exhibit 15.

Mr. Williams: The specimen of concentrates and the bag in which it was put and forwarded, which was marked for identification
2307 "defendant's concentrate No. 2" offered in evidence as plaintiff's exhibit 16.

Bag admitted in evidence and marked Plaintiff's Exhibit 16.

Mr. Williams: The specimen of concentrate after some treatment described by the evidence marked for identification "original Chandler sample" offered in evidence as plaintiff's exhibit 17.

Bottle containing concentrates admitted in evidence and marked plaintiff's exhibit 17.

Mr. Williams: I may say generally that these depositions and these exhibits complete that part of the testimony which was described in the affidavits which were presented to your honor on the order to show cause and motion for preliminary injunction and give the details and particulars of the act which your Honor then held proved infringement with an oil proportion which was much less than one per cent, and then there is the general stipulation connecting up these concentrates with the defendant, and the general statement as to operation, concludes the prima facie case as to infringement.

Mr. Kremer: Counsel having concluded his prima facie case as to infringement we now move to strike out all the testimony with reference to the infringement for the reason that the act of infringement has not been shown or proven by competent testimony.
2308 The Court: Of course the court has not all the testimony in mind, only what is in these depositions. For the purpose of the record the motion will be denied.

Defendant excepted.

Mr. Kremer: We now move the court to strike out all of that portion of the statement of counsel as to the showing of infringement or showing that defendant used less than one per cent. of oil, insofar as the same refers to any statement contained in the affidavits on the Hyde hearing, and we move particularly to strike out from consideration in the record all affidavit testimony in connection with the infringement, if the same is to be considered as to the question of whether or not there has been an infringement.

The Court: Of course the statement of counsel is not evidence. You move to strike out his statement?

Mr. Kremer: Yes, sir; it was offered in an evidentiary capacity; it was an explanation of a certain deficiency, and we do not want the statement to stand unchallenged, because somebody might say that it was stated in open court and not challenged.

The Court: Counsel did not intend that.

Mr. Williams: Certainly not; it was merely an explanation.

Mr. Kremer: I know, but it is sometimes dangerous to allow those things to stand unchallenged.

The Court: I understand that. And your other motion?

Mr. Kremer: Yes, I object to the affidavit.

2309 Mr. Williams: I did not offer the affidavit in evidence; I merely called attention to the fact that the affidavits were repeated in the depositions; that the depositions contained the things that were shown in the affidavits.

Mr. Kremer: I thought you were considering the affidavits upon the application for the preliminary injunction as testimony in this case, to be frank with you.

Mr. Williams: Not for a moment.

The Court: The court does not think any ruling is required.

Mr. Kremer: That is all right; I wanted to be sure that he was not considering those as testimony in the case.

The Court: That is perfectly proper under the circumstances.

MAXWELL W. ATWATER, called as a witness for plaintiff, after being duly sworn, testified as follows:

Direct examination.

By Mr. Garrison:

Q. 1. Where do you reside?

A. Basin, Montana.

Q. 2. What is your business?

A. Mining engineer.

Q. 3. Were you connected with the Butte and Superior

2310 Mining Company, whatever its then title was, in the year 1911?

A. I was connected with the Butte & Superior Mining Company, yes, sir.

Q. 4. Say in the month of March 1911, and from then on, what was your position with that company?

A. General superintendent.

Q. 5. How long did you continue general superintendent?

A. Until February, 1913.

Q. 6. Do you know James M. Hyde?

A. I do.

Q. 7. Who conducted the negotiations with Hyde, arranging for the installation of an ore flotation concentrating plant for the Butte & Superior Mining Company?

A. I did.

Q. 8. When were those arrangements made?

A. In the summer of 1911.

Q. 9. Between you and Mr. Hyde?

A. Yes, sir.

Q. 10. Was anything said by either of you at that time concerning the possibility of litigation over the question of installation of an ore flotation concentrating plant by the Butte & Superior Mining Company?

Mr. Kremer: We object to this.

Mr. Garrison: You can't object when I say was anything said; he might answer "no." It is foolish to object until he has answered yes or no.

2311 Mr. Kremer: I will do these things as I think they ought to be done. I object for the reason that any statement of whatsoever kind and character made by Mr. Hyde in connection with litigation or by Mr. Atwater to Mr. Hyde in connection with litigation would be incompetent, irrelevant and immaterial and not binding upon the defendant in this action. Mr. Atwater's authority, under the rights of superintendent not being of such a character as to justify charging the defendant company with any statement made by either Mr. Hyde or Mr. Atwater *or* any kind or character in connection with litigation. It would in nowise be binding on this defendant company.

The Court: The question being merely preliminary, the objection will be overruled.

Defendant excepted.

A. Yes, sir.

Q. 11. Which one of you made any statement about that matter?

Mr. Kremer: The same objection, and for the further reason that any agreement between this company and James M. Hyde is embodied in the written agreements here on file and presented as exhibits in this case by the plaintiff, and any statement looking to the preliminary arrangement would be entirely improper and incompetent for any purpose, being presumed to have been merged in the written contract.

2312 The Court: Well that might be true between Hyde and the company, but not as to a third party. The objection is overruled.

Mr. Garrison: So as to make the matter straight, may I call the court's attention to this: the agreement called for here would properly, of course, cover, as the language does cover, all agreements between the defendant corporation and Hyde concerning this subject matter. They have produced no written agreement concerning the conduct, control, payment of expenses of, or other participation in the defense of the Hyde suit, or in any prospective litigation in which Hyde might become involved by reason of his employment in this business; therefore the rule cannot possibly apply that we are relegated to the written agreement, since the written agreement is entirely silent. Now, there may be a written agreement which they have not produced, because in Exhibit 5 Mr. MacKelvie, the president of the company, states as follows: "I have had in my mind the outcome of the suit of Minerals Separation Company against Hyde, but the contract with Hyde was entered into practically with that knowledge of this pending litigation, and later the company made an agreement with Hyde to defend this suit for him, and at that time did not ask for any modification of the then existing contract."

Mr. MacKelvie said they made an agreement to defend the Hyde suit for him. If they did, and that is in writing, we are entitled to it. If they did not, then the objection that we have no right to get the contents of an agreement because it is in writing, falls of its own weight.

2313 The Court: You may proceed.

Defendant excepted.

A. Hyde first spoke to me about possible litigation.

Q. 12. What did Mr. Hyde say?

Mr. Kremer: Objected to for the reason that it is hearsay, incompetent, irrelevant and immaterial, not binding upon this defendant. Any statement made by James M. Hyde would not be chargeable as against this defendant. It is strictly hearsay.

The Court: If the proof in that direction is not sufficient to make this conversation competent, the court will disregard it in making up its decision. At this time the objection will be overruled.

Defendant excepted.

A. Hyde said that if we engaged in the concentration of ores by flotation under his advice, that we would doubtless be sued by the Minerals Separations Company.

Q. 13. What else did he say about that?

A. You mean in connection with the arrangement which he and I had made?

Q. 14. Yes, in connection with the arrangement that you made with him.

A. He asked as part of our agreement that the company stand the expense of any suit that might be brought against him.

Q. 15. Anything else?

A. I don't remember anything more at that time.

2314 Q. 16. What did you say in response to that?

A. Well, I said that I would, as far as I was concerned, agree to it and would recommend that it be done.

Q. 17. Did Mr. Hyde at that time make any mention to you of any patents of his own?

Mr. Kremer: I object to that as incompetent, irrelevant and immaterial, hearsay testimony and in no way binding upon this defendant, the witness upon the stand not shown to have been vested with any authority to act or in a contractual capacity for the defendant and the statement made by Mr. Hyde to him was nothing more than reciprocal statements of strangers to this defendant.

The Court: The ruling is the same as the last. Objection overruled.

A. He made no mention of any patents of his own at that time.

Mr. Garrison:

Q. 18. Did Mr. Hyde ever make any statement concerning any

patents of his own or any intention upon his part to take out any patents?

Mr. Kremer: I object to that for the same reason, and the additional reason that it is incompetent, irrelevant and immaterial for any purpose whatever, whether he did or did not.

The Court: Objection overruled.

Mr. Kremer: Exception.

A. Well, later in the year.

Mr. Garrison:

Q. 19. Well, just answer yes or no; he did or he did not.

2315 A. Yes, sir, he did.

Q. 20. Now, when did he make any such statement to you?

Mr. Kremer: The same objection.

The Court: Objection overruled.

Mr. Kremer: Exception.

A. Later on in the year in October or November of 1911.

Mr. Garrison:

Q. 21. And where were these statements made; where was this conversation held?

A. In Butte or in Basin.

Q. 22. And at that time had the suit of Minerals Separation Limited against James M. Hyde been commenced?

A. Yes, it had.

Q. 23. Now, what did Mr. Hyde say concerning any patent of his own or his intention with respect to taking out any patents of his own?

A. He said he was going to take out certain patents covering the particular points in which his process differed from the Minerals Separation process.

Q. 24. Well, what did you say to him?

A. I asked him why he took out patents on a process which he considered the patents which had already existed were of no value.

Q. 25. And to what process did you then refer?

Mr. Kremer: I move to strike out the statement of the witness as entirely hearsay, volunteered statements.

The Court: Objection overruled.

2316 Mr. Kremer: Exception.

Mr. Garrison: Please read the question.

(Question read as follows: And to what process did you then refer?")

Mr. Garrison: And to what process did you refer? You said to him—you had asked him why it was he contemplated taking out patents where he considered those that had already been taken out

to be void. Now, I want to know to what patents you referred in that connection?

A. Minerals Separation Company patents in suit.

Q. 26. In suit. And what was his answer?

A. He answered that he had been advised to do so.

Mr. Kremer: We interpose the same objection.

The Court: The like ruling.

Mr. Kremer: Exception.

A. He answered that he had been advised to do so by his counsel.

Mr. Garrison:

Q. 27. During the time that you were the general manager—that was the title?

A. Superintendent.

Q. 28. During the time that you were superintendent from the date that you have mentioned in 1911 down to the time that you ceased your connection with the company in February of 1913, did you at any time pay moneys to James M. Hyde on behalf of the Butte & Superior Company, the defendant?

A. Yes.

Q. 29. Did you pay him a flat sum of money per day or did you pay him moneys made up of items of expenses, or both?

2317 A. We paid him so much a month.

Q. 30. Was that so whether he was here, at Basin or whether he was traveling away somewhere else?

A. I believe that only applied while he was working in Basin.

Q. 31. And while he was away——

A. Or here.

Q. 32. (Continuing:) —somewhere else; what items did you pay him for?

A. His expenses.

Q. 33. The company paid him his expenses?

A. The company paid his expenses on trips away in that year.

Q. 34. Did you continue to pay him sums of money—to pay sums of money to Hyde during the whole time that you were connected with the company down to February, 1913?

A. No.

Q. 35. Did you—When did you cease paying him moneys?

A. I think when he left Basin.

Q. 36. And about when was that?

A. That was—why I think he received a salary after he left Basin. I will correct that. While he was working at Butte on the flotation plant here.

Q. 37. At Butte.

A. At Butte. I believe he still received so much a month.

Q. 38. Yes. Just to make that clear, the first plant that was erected at Basin?

2318 A. Yes.

Q. 39. And then another one was erected at Basin?

A. Right.

Q. 40. And then another one was erected at Butte.

A. Yes.

Q. 41. All by the Butte & Superior Mining Company, the defendant?

A. Yes.

Q. 42. Were these payments made to Hyde in the form of voucher checks, the signature of which would be a receipt?

A. Yes, sir.

Q. 43. And where were these voucher checks, after they came back, deposited—where were they then kept?

A. The checks were drawn on the First National Bank of Butte and were returned to the Butte & Superior Copper Company's office in Butte.

Q. 44. And, so far as you know, they are still there?

A. Yes, so far as I know.

Q. 45. Was he paid expenses incurred by him while attending the trial, the taking of evidence, consultation with counsel, and so forth, in the suit of Minerals Separation Company, Limited, against James M. Hyde?

A. I don't know.

Q. 46. The vouchers would have to show that, would they?

A. Yes sir.

Q. 47. He was, however, as I understand it, paid expenses
2319 when away from Basin after you made the arrangement with him?

A. On his trips away from Basin to Duluth or New York and I believe to London, but I am not sure about that. He rendered statements of expenses.

Q. 48. Duluth at that time was the head office of the company was it not?

A. Yes.

Q. 49. And what had New York to do with the company—was there a branch office there is all I want to know?

A. In 1911?

Q. 50. Yes.

A. No.

Q. 51. Was there in 1912?

A. Yes, sir—there wasn't a branch office; it was the head office.

Q. 52. They had moved it from Duluth to New York?

A. In 1912, I believe, yes, sir.

Q. 53. Was that when Mr. Jackling became connected with the company?

Mr. Kremer: I object to that as incompetent, irrelevant and immaterial; not a thing on earth to do with the question.

The Court: Overruled.

Mr. Kremer: Exception.

A. Yes.

Mr. Garrison:

Q. 54. And did Mr. Jackling remain with the company down to the time that you left?

2320 A. Yes.

Q. 55. Now, you have said that there were three ore separation flotation plants erected during the time that Hyde was engaged in this business, on at Butte. When was that erected, generally speaking?

A. The one at Butte?

Q. 56. I beg your pardon. I mis-spoke myself. The first one at Basin?

A. In July, 1911, the first one.

Q. 57. That was erected with moneys of the Butte & Superior Mining Company, the defendant?

A. Yes, sir.

Q. 58. And the ore concentrated in it belonged to whom?

A. Belonged to the Butte & Superior Company.

Q. 59. And the concentrates belonged to whom?

A. To the Butte Superior Company.

Q. 60. Do those same answers remain true as to the second plant erected at Basin and the third plant erected at Butte?

A. They remain true.

Q. 61. Did you voluntarily appear here today or come under subpœna?

A. I was subpœnaed.

Mr. Garrison: You may take the witness.

Cross-examination.

By Mr. Kremer:

X Q. 62. When were you subpœnaed?

A. Monday morning, yesterday morning.

2321 X Q. 63. Did you make any per diem arrangements for compensation with the Minerals Separation?

A. I made no arrangements. I receive a fee.

X Q. 64. How much of a fee?

A. $1.50 a day.

X Q. 65. $1.50 a day. Did you receive the same fee for testifying for the Minerals Separation in the Miami case?

Mr. Garrison: I object to that as absolutely irrelevant and immaterial what he received in some other case.

Mr. Kremer: We have a right to show his interest.

The Court: Just to show under the circumstances if there is any interest or feeling. You may answer. I understand the Miami case was a case by this plaintiff involving the same process.

Mr. Garrison: Yes, but not against these defendants, unless they concede it. Do you concede that you were the defendant of the Miami case.

Mr. Kremer: I have asked the witness a question.

The Court: The court should not interject any understanding. I will leave you show it by evidence. Proceed.

A. I received quite a different compensation at the Miami trial.

Mr. Kremer: How much compensation did you receive for testifying for this plaintiff in the Miami case?

2322 Mr. Garrison: I object. How can this be relevant or material in this suit unless this defendant concedes that they were the defendants or unless they participated in the defense of the Miami case.

The Court: It would be only to show the relation that they had or might exist or did exist between the plaintiff and this witness. You asked him if he had been subpenaed in order to show that he was here not voluntarily. Now, I think they had a right to go a little farther, but I don't think the court will insist on this point. He can assume, I think, that there was a good substantial fee. The objection will be sustained.

Mr. Kremer: Exception.

X Q. 66. How long were you on the Miami case in Wilmington, under retainer from the Minerals Separation?

A. About six weeks.

X Q. 67. Had you, previous to that time, been under retainer from the Minerals Separation?

Mr. Garrison: I object. I can't see how it is relevant or material in this suit.

The Court: To show the relation between the parties, whether he has reason to feel very friendly. He may answer. Objection overruled.

A. Do you mean under retainer?

Mr. Kremer: I mean per diem arrangement, like all experts—most of them, rather?

A. On account of litigation, do you mean, or how?

X Q. 68. In any capacity, Mr. Atwater. Why quibble about it?

2323 Mr. Garrison: I object to that utterly unnecessary statement of counsel.

The Court: Yes, he may answer.

A. No.

Mr. Kremer:

X Q. 69. Had never been employed by them before the Miami case?

A. No.

X Q. 70. Did you seek employment from them in the Miami case or did they approach you?

Mr. Garrison: I object, if your honor please, it does seem to me we are getting very far afield here.

The Court: He may answer that question. The objection is overruled.

A. They asked me to testify?

Mr. Kremer:

X Q. 71. In discussions with you, your testimony in that case and this, did they suggest to you that in view of the fact that you had previously been connected with the Butte & Superior as a matter of agent for the Butte & Superior that your testimony would be valuable to them?

Mr. Garrison: I object. There is an assumption in that question that is utterly unwarranted by anything in the proof.

The Court: Objection sustained.

Mr. Kremer: Exception.

X Q. 72. Did you communicate to them or did they solicit from you the fact that you had been employed by this defendant in the past?

Mr. Garrison: I object. That is based on an assumption.

2324 Mr. Kremer: It seems to me here is a man that goes upon the stand and declares he was the general manager and contractor for the defendant; he says he comes here under subpœna. The fact is now disclosed he has been under retainer and has been compensated by the Minerals Separation Company in past suits. We believe—we not only have a right, it seems to me, to show that this witness is here under a friendly relationship with the Minerals Separation Company, but if we can to show that his employment was sought by reason of the fact that he had had some previous connection with this defendant——

Mr. Garrison: My objection don't go to that point. It is the form of the question, it seems to me.

Mr. Kremer: No doubt the witness can answer it.

The Court: Read the question.

(Question read.)

The Court: I think you better change the form a little. It is rather awkward as it is—not to dictate your language at all.

Mr. Kremer: I will propound another.

Mr. Garrison: Make it clear.

Mr. Kremer: It is as clear as I can make it, but I will attempt to do better.

X Q. 73. In arranging to engage you in either of these cases or in the Miami case, confining it to one, did they suggest to you that they desired your testimony because you had previously been employed in connection with flotation matters?

2325 Mr. Garrison: I object as utterly immaterial and irrelevant.

The Court: What are you trying to arrive at, whether he volunteered or whether they solicited his services?

Mr. Kremer: Exactly.

Mr. Garrison: Confining himself to the Miami case.

Mr. Kremer: I was going to supplement that by asking with respect to this case, in order to prevent the equivocal statement that "they employed me before I was subpœnaed in this case." The witness has already testified he was subpœnaed here. He didn't come voluntarily.

The Court: Read the question.

(Question read as follows: "In arranging to engage you in either of these cases or in the Miami case, confining it to one, did they suggest to you that they desired your testimony because you had previously been employed in connection with flotation matters?")

Mr. Kremer: I wanted to find out whether he communicated to them the fact that he was employed by the Butte & Superior and solicited employment from them, or whether they suggested to him by reason of his employment by the Butte & Superior they would like to engage him.

The Court: Put that in the form of a question.

Mr. Kremer:

X Q. 74. Did you solicit employment from the Minerals Separation, stating to them that you had previously been employed
2326 by the Butte & Superior Company?

Mr. Garrison: In what case?

Mr. Kremer: In any case.

Mr. Garrison: I object, if your honor pleases, to the question of any case.

The Court: Let him finish the question.

Mr. Kremer (continuing) —or did they suggest to you that they desired to employ you for the reason of the fact that you had been in the employ of the Butte & Superior Company?

Mr. Garrison: That is based on an assumption.

Mr. Kremer: No assumption. It is a plain and simple question as to whether a certain condition is true.

The Court: It is obvious that either they must have solicited him to testify for them or he must have volunteered.

Mr. Kremer: No, that is not the question.

The Court: I think not.

Mr. Garrison: There is a question with an assumption in it, if your honor will read the question. They are making him their witness on this, and they are not asking him to state facts or to answer questions that may be answered yes or no. In a question like that it makes it impossible to do anything but confuse the answer. I have no objection to his asking a direct question.

The Court: I think they are double questions, as a matter
2327 of fact. Single them out. The objection will be sustained. Put another question.

Mr. Kremer: That is what I did before and counsel objected, and I conformed to the ruling of the court.

X Q. 75. Did you solicit employment from them upon the representation that you had been previously employed by the Butte and Superior?

A. No.

The Court: That again is two questions; it is like the old question: "Have you quit beating your wife?"

Mr. Kremer: I will reform the question. Q. Did you represent to the Minerals Separation in your discussion with them about employment that you had previously been connected with the Butte & Superior?

Mr. Garrison: I object to that question; there is an assumption in there that he represented something to them.

Mr. Kremer: It does not matter whether he did or not. He can answer.

Objection overruled. Plaintiff excepted.

X Q. 76. Answer yes or no.

A. No.

X Q. 77. Did they suggest to you that they desired your services for the reason—by reason of the fact that you had been in the employ of the Butte & Superior Company?

A. No, they did not.

2328 X Q. 78. Did you testify as an expert in the Miami case?

A. (Hesitating.)

The Court: Will you answer?

A. Yes, I did.

X Q. 79. Did you testify in matters appertaining to the use of oil flotation, other than those things which you had observed during the time which you operated the Butte & Superior mill?

A. (Hesitating.)

The Court: Well, there is no objection.

Mr. Garrison: If your honor wants to go on with this I am not going to object any more.

The Court: You don't need to go into this. The court understands the situation.

Mr. Kremer: I want to make it perfectly clear.

Mr. Garrison: I did not object.

Mr. Kremer: I know you did not. I want the court to understand my position. We want to make it perfectly clear that the only reason in the world that Mr. Atwater was employed by the plaintiff, or the only reason Mr. Atwater had for assuming to accept employment from the plaintiff was the fact that he had previously been employed by the Butte & Superior and knew something about the facts of its operation.

Mr. Garrison: In the Miami case?

Mr. Kremer: In the Miami case or any other case; any case.

The Court: I can't see that you need to go as far as that in order to make it clear that this witness has worked for the company

2329 and has been required to testify to facts that he knew during that employment. The objection will be sustained, or the court itself will object to proceeding further along that line.

Defendant excepted.

X Q. 80. Mr. Atwater, during the time that you were employed by the Butte & Superior you were the superintendent of the company, were you not?

A. I was general superintendent of the company.

X Q. 81. Under a salary of $250.00 a month, were you not?

A. The salary was a little larger than that.

X Q. 82. How much was it?

A. I believe I received $400.00 a month and my house rent.

X Q. 83. When you quit?

A. When I quit, yes, sir.

X Q. 84. What were you getting in 1911?

A. About three hundred——

Mr. Garrison: I object to that as irrelevant.

Mr. Kremer: I think that with this character—that this character of testimony does require an explanation. I want to show the nature of his employment, that incident to the character of his employment he had no right to make contracts on behalf of this company for the conduct of litigation or otherwise, save and except the hiring of men in the mine or in the mill.

2330 The Court: You may proceed with that. The objection to the last question will be sustained.

Defendant excepted.

X Q. 85. Mr. Atwater you ran the mine, did you not? You were superintendent of the mine?

A. Yes, I was superintendent of the mine.

X Q. 86. When did you become superintendent of the mine?

A. In October, 1909.

X Q. 87. And you occupied that same position in 1911, did you?

A. In 1910 or '11, I don't recall which I was promoted from superintendent of the mine to general superintendent of the company.

X Q. 88. As General Superintendent you had charge of the operation?

A. I did.

X Q. 89. Of the mine and mill?

A. Yes.

X Q. 90. You had a checking account covering the operations of the mine and mill?

A. Yes.

X Q. 91. You had supervision over the books of account here locally?

A. Yes.

X Q. 92. The books at that time were kept where—to refresh your memory weren't they kept in Duluth?

A. At that time the books were kept in Duluth.

2331 X Q. 93. But you made entries here?

A. Yes.

X Q. 94. Showing all of your expenditures?

A. Yes.

X Q. 95. And you saw that they appeared on the books that were kept here?

A. Yes.

X Q. 96. Do you recall keeping an account for James M. Hyde?

A. Yes, sir.

X Q. 97. You entered that, or saw that it was entered under your direction on the books of the company, did you?

A. Yes.

X Q. 98. That was your duty, was it not?

A. I did not enter it on the books of the company.

X Q. 99. No, *that* you saw that it was entered, did you not?

A. Yes; for the payments made to him, I O. K.'d.

X Q. 100. Who was the bookkeeper at that time?

A. C. M. Everett was auditor of the company at that time in the Butte office, and before Everett came, I believe A. L. Swan was head bookkeeper.

X Q. 101. You stated that you discussed with Mr. Hyde the question of a contract for the installation of a plant at Basin?

A. I said I discussed arrangements for the installation of a plant at Basin.

2332 X Q. 102. When was that discussion had?

A. In June or July of 1911.

X Q. 103. Was it reduced to writing, the results of your conversations and consultations with Mr. Hyde?

A. Yes.

X Q. 104. By whom?

A. By yourself (Mr. Kremer).

X Q. 105. I hand you a contract marked plaintiff's exhibit 1, and I ask you to examine the same and state to the court whether or not that does not embrace the full understanding that you had made or were authorized to make with Mr. Hyde.

A. I don't think it is necessary to read it all through. It is the contract.

Mr. Garrison: I would like to have the question read to the witness before he answers.

The Court: You can ask him yourself. He may acquaint himself with the contents so he can say if all the arrangements so far as he knew had between him and Hyde appeared in that contract.

Mr. Garrison: He is asked whether or not it contains the full terms. How can he tell unless he reads it all?

Mr. Kremer: I am entitled to the writing as a matter of law; my objection was that the full contract was embodied in that written instrument.

The Court: Never between strangers.

Mr. Kremer: The purpose is to show that he was the man
2333 that made it for the Butte & Superior Company.

X Q. 106. Are you familiar enough with the contract to answer that question?

A. I think so, yes, sir.

X Q. 107. State to the court whether or not that does not embrace the full understanding that you had made or were authorized to make with Mr. Hyde?

A. As I remember it, it does. I cannot commit this thing to memory while I am sitting here in the chair, unless I keep you here for a week, but as I remember it, this paper embodies all the points of our discussion, yes.

X Q. 108. And all the payments that you made to Mr. Hyde were made under the terms of this contract, were they?

A. All the monthly payments that I made to him while he was working in Basin, yes, sir.

X Q. 109. When you made the statement that you paid him a salary, using the word salary——

A. I did not make that statement.

X Q. 110. Do you now say that you did not? I am not arguing with you, but I am willing to accept your statement. Did you pay him a salary?

A. I said that I paid him so much a month regularly.

X Q. 111. Now, Mr. Atwater, I ask you the question; did you pay him a salary?

Mr. Garrison: Isn't that a matter of law, what that was
2334 called?

Mr. Kremer: No, that is a matter of contract.

Mr. Garrison: I ask for a ruling on that.

The Court: He has stated what he paid him and how he paid it. I think the term you attach to it is rather a question of law, what it would be considered, unless you get the details of what it was paid for.

Mr. Kremer: It is in evidence, and if your Honor will permit, I will read it so the question may be settled now as well as any other time.

"He was to receive no sum save and except his personal expenses while engaged in the mill work, such sum not to exceed $5.00 per day while installing the plant." Was that the contract?

A. That is what is written there?

X Q. 112. Isn't that what you paid him?

A. No, we paid him regularly $150.00 a month for a thirty day month, on that basis.

X Q. 113. Of his expenses at Basin?

A. Yes, that is the way we put it, to cover his living expenses at Basin we paid him so much, yes.

X Q. 114. In accordance with the terms of this contract, or did you have any other authorization to pay him besides this contract?

A. No, I had no other authorization besides that contract. We paid him on that.

Mr. Kremer: So we submit that the matter is clear.

Mr. Garrison: Isn't it already in evidence?

2335 Mr. Kremer: I say that the matter is clear.

X Q. 115. Mr. Atwater you stated that you had paid Mr. Hyde for his expenses of his trip to Duluth and New York. Do you recall when that payment was made?

A. No, I don't recall when either of those payments were made.

X Q. 116. Did you make it in one payment or in two?

A. He would turn in his expense account when he returned from such a trip, and I would O. K. his expense account and he received his money from the auditor.

X Q. 117. Do you recall in what year either of those sums were paid?

A. In 1911 he made a trip and I put my O. K. on his statement, as I said before.

X Q. 118. Now where was that trip to?

A. I think that was to Chicago.

X Q. 119. And then you told us that he made a trip to New York in 1912 I believe it was?

A. Yes, I think so.

X Q. 120. Now then, the only sums, as I understand you—summing them up before passing—that you paid Mr. Hyde was his $5.00 a day under the contract in evidence, and his expense account for the trip to Chicago and his expense account for the trip to New York. Were there any other payments?

A. No, that is all the payments we made. There might
2336 have been other trips, which we may have paid; I don't recall; but there were just expenses of such trips and this monthly payment that I mentioned before.

X Q. 121. You had charge of all the employes of the Butte & Superior Company, outside of the office, and the professional or legal department, did you not?

A. Yes.

X Q. 122. Could you discharge or could you have, in your judgment, discharged Mr. Hyde?

A. Yes.

X Q. 123. As an employe?

A. Yes, at that time I could have.

X Q. 124. Upon what do you base that statement—the contract?

A. I based it on the fact that the president asked me why I did not discharge him—the president of the company.

X Q. 125. Who was the president?

A. A. B. Wolvin.

X Q. 126. That was where and when?

A. That was in Butte in 1912.

X Q. 127. Was he working for you then?

A. Yes, he was there, supervising the construction of the flotation plant.

X Q. 128. In your new mill?

A. Yes.

X Q. 129. The Basin contract had ceased at that time, had it?

2337 Mr. Garrison: I object to that question.

Objection withdrawn.

X Q. 130. Were you, at that time, operating at Basin?
A. Yes.
X Q. 131. And was the flotation department operating then?
A. Yes.
X Q. 132. Was Mr. Hyde operating it?
A. He was.
X Q. 133. And was he staying at Basin?
A. He spent part of his time at Basin and part of his time in Butte. He was supervising the construction of the flotation plant in Butte, or was supposed to be supervising it, and he was also attending to this plant in Basin. He was also making trips away during those months; he was not here all the time, either in Basin or Butte.
X Q. 134. When you say why you didn't discharge him, you mean why you didn't terminate the contract that is put in evidence here, do you not?
A. (Hesitating.)
X Q. 135. Just answer that.
A. Well, the question was put to me by Mr. Wolvin; you asked me and I answered it. He did not say, terminate the contract; he asked me why I didn't get rid of him.
X Q. 136. I will ask you to examine that contract and state if it does not provide that whenever the superintendent of the
2338 Butte & Superior desires to do so, he can terminate the contract.

Mr. Garrison: I think whether that appears or not is a matter for the court and not the witness.
The Court: You may read it to him.
Mr. Kremer: I did not want to take up the time. I thought he had it in mind.
The Court: If it appears there, say so, and base a question on it.
Mr. Kremer: The question was based upon what does appear, if your Honor please; it is only a question of taking time to read it.

X Q. 137. Was it not under the assumption that the Hyde process was not adaptable—was not profitable—that you considered terminating the contract?

Mr. Garrison: I object; there is no question whether he considered terminating the contract; he testified that the president asked him why he did not discharge or get rid of Hyde.

Objection sustained. Defendant excepted.

Mr. Kremer: Well, on that basis it is only a question of——
The Witness: I was——
Mr. Garrison: No, no.

Mr. Kremer: If counsel is doing that for my benefit, he may cease. It is not necessary.

Mr. Garrison: I was doing it in the interest of propriety.

Mr. Kremer: It is quite unnecessary.

The Court: Proceed.

2339 X Q. 138. I will ask you if it was not in connection with the fact that the milling operation did not show the results that you had hoped, that the conversation took place that you referred to with reference to removing Mr. Hyde?

Mr. Garrison: I object. The witness did not testify to anything except that Mr. Wolvin said——

Mr. Kremer: That is exactly the situation I refer to.

Mr. Garrison: And he has stated what Mr. Wolvin said and now he is asked whether that was not on an assumption in his mind or Mr. Wolvin's mind; an entirely improper question.

Objection sustained. Defendant excepted.

X Q. 139. Did Captain Wolvin at that time state to you, and was not the substance of the conversation in connection with the incident to which you referred, that the milling operations under Hyde were not satisfactory, and that you should get rid of him?

A. My recollection of that conversation with Capt. Wolvin was that the trouble was not with the process; the trouble was with Hyde. We did not expect to break the contract. Capt. Wolvin advised me, or asked me why I did not get rid of Hyde.

X Q. 140. You did not expect to break the contract—by that you mean to say that you intended to carry out the contract as it was written, is that correct?

A. Yes, that was correct.

2340 X Q. 141. Now, Mr. Atwater, in connection with the matter of the keeping of vouchers. Do you know where the vouchers covering the period during which you issued checks to Mr. Hyde—where they were placed at the time that you left the employ of the company?

A. Well, at the start, anyhow, those vouchers were kept in the mine office—in the office at the mine.

X Q. 142. Where were they at the time that you left, if you know—I ask so that we can make search for them.

A. I think likely those vouchers were still at the mine, but they might have been at the office down town. We had an office down town when I left the company.

X Q. 142½. You could not be sure where they were?

A. Either one or the other.

X Q. 143. I ask for the purpose of locating them.

A. One or the other.

X Q. 144. Was there any other contract between the Butte & Superior Company and Mr. Hyde, to your knowledge, save and except the contract here in evidence—of course that is during the time you were connected with the company.

A. There was a modification of that agreement.

X Q. 145. Was that made during the time that you were with the company?

A. Yes.

2341 X Q. 146. I hand you this, plaintiff's Exhibit 2, and ask you if this is the paper.

A. Yes, this is the supplementary agreement.

X Q. 147. Now, was there any other contract between the Butte & Superior Company and Hyde during the time that you were connected with the Butte & Superior Company, that you now recall?

Mr. Garrison: Unless that is confined to his knowledge, that is an improper question.

The Court: Certainly.

Mr. Kremer: It could not be directed to anything else.

X Q. 148. Of your own knowledge?

A. I don't recollect any other one at this time.

X Q. 149. Now, Mr. Atwater, in your conversation with Mr. Hyde, the first one that you refer to, where did that occur?

A. My first conversation with Hyde?

X Q. 150. Yes, the one that you testified to wherein he said that if you engaged in the concentration of ores as he directed that you probably would have trouble with the Minerals Separation, or something to that effect?

A. Up at the mine, the Black Rock Mine.

X Q. 151. What year was that in?

A. 1911.

X Q. 152. What month, do you recall?

A. Not exactly; it might have been May, but I think it was June or July.

2342 X Q. 153. It was before the entering into this contract?

A. It was.

X Q. 154. That is in evidence?

A. Yes. I said so.

X Q. 155. And Captain Wolvin was doing the financial negotiations with Mr. Hyde, was he not?

A. Well, Captain Wolvin, the president of the company, O. K.'d the negotiations, but——

X Q. 156. They could not be closed without his O. K., is that not the fact?

A. (Hesitating.)

X Q. 157. Well, is it or is it not a fact?

A. Well, can't I stop and think while you ask me? I am trying to recall, that is all.

X Q. 158. Certainly, if you wish to think.

A. Yes. There was never any contract—never any direct definition of how far my authority extended. As that contract looked to us, then, it would have probably not been questioned if I had signed that contract instead of Captain Wolvin; but in the natural course of such operations it would have been up to the president of the company to ratify such a contract.

X Q. 159. And that was the course pursued in the general conduct of affairs of the Butte & Superior Company, was it not?

A. Not in general, no.

X Q. 160. Well was it, or was it not; I ask you the question you followed in matters of contract or referring to unusual ex-
2343 penditures or expenditures outside of the ordinary conduct of the mines—were not those submitted to the president or the board of directors for ratification?

A. It was customary for me to submit it to the board of directors.

X Q. 161. Now you said that there was no mention made of any particular patent in your discussion with Mr. Hyde. Did I understand you to make that statement?

A. This written contract—will you ask me that again?

X Q. 162. I will connect it with something that I think will refresh your memory. You said that Mr. Hyde told you that he had a patent, for improvements upon certain then claimed patents. Is that correct?

The Court: He did not say that, I think.

Mr. Garrison: I object to that.

X Q. 163. Certain issues of patent——

The Court: He testified that Hyde told him that he was going to get a patent.

X Q. 164. He said he was going to take out certain patents, improvements on certain patents then in existence?

A. That is not what I said.

Mr. Garrison: Not at the first interview.

X Q. 165. No, not at the first conversation, but the conversation wherein he told you that he was going to take out certain patents.

2344 The Court: On the particulars wherein it differed from the Minerals Separation process.

Mr. Garrison: Yes, sir.

The Court: Proceed.

X Q. 166. Where did that conversation occur?

A. In Hyde's laboratory in Butte.

X Q. 167. Where was Hyde's laboratory in Butte?

A. It was either at the Napton or the Thornton; it was at the Napton Hotel or rooming house.

X Q. 168. You stated that you asked him why he did not take out patents covering improvements upon the process, when he claimed that certain other patents were void; is that what you stated?

A. I did not use the word——

Mr. Garrison: He is misquoting the witness as to that; he did not say anything about improvements.

X Q. 169. Well, I will ask you to repeat that conversation, then; what did he tell you that he was going to do?

A. He told me he was going to take out patents on particular parts of his process, which he considered patentable; one part, I think, on the use of acid, but I don't recollect. He told me——

X Q. 170. One of recleaning?

A. Yes, I think so. I did not pay much attention to what his patents were to cover. I remember that he was going to take out patents.

X Q. 171. Do you know whether he did take out a patent?

2345 Mr. Garrison: I object.

The Court: He can answer if he knows.

A. Yes, I knew that he took out a patent.

X Q. 172. He told you that he had been advised by counsel that he had something that was patentable, and to take it out, did he?

A. Yes.

Redirect examination.

By Mr. Garrison:

R. Q. 173. Did he mention who the counsel were who had advised him?

A. Yes, sir.

R. Q. 174. Who did he say they were?

A. Mr. Sheridan.

R. Q. 175. In answer to a question upon cross examination, and after examining this contract, plaintiff's exhibit 1, which I now hand you, you stated that it represented the arrangement, the full arrangement that you had made with Hyde. Kindly point out to me the place therein which refers to the conducting or paying the expense of expected litigation.

Mr. Kremer: That is objected to as improper redirect and for the reason that there was no testimony with reference to the contract having been entered into between Hyde and the Butte & Superior for paying the expenses of prospective litigation. There is no contract of that character testified to.

The Court: I think so.

2346 Mr. Kremer: The witness said he had no authority except that that was given there. He was asked if a part of the agreement was not that the company stand *what* expenses of any suit brought against him. He said as far as he was concerned he would recommend that should be done, but there is no evidence that it was ever done, and the contract was drawn afterwards, and it was not done, and there is no testimony as to the authority. That is the reason I did not cross examine upon that.

The Court: Well, the question does not seem objectionable in that particular. If there is anything of that sort in there—you are familiar with the contract—point it out.

Mr. Garrison: It is not there.

The Court: If it is not there, so advise the witness and ask the question based on that.

R. Q. 176. You will observe, Mr. Atwater, that there is nothing whatever in that contract concerning the payment of expenses of litigation. You may take my word for that.

A. All right.

R. Q. 177. Based upon that, do you correct your answer, in which you stated that this contract contained the full recital of the things that you had agreed upon with Mr. Hyde?

Mr. Kremer: We object to that for the reason that there is no testimony that the witness did agree upon it with Mr. Hyde or had authority to agree upon it with Mr. Hyde.

2347 The Court: There is testimony tending in that direction. I think the question fair under the circumstances. As the court has said, you can object later if it is not proven that there was an arrangement of that character, and the objection will be overruled.

(Question read.)

A. I will have to correct my statement in that matter.

R. Q. 178. Please correct it; please make the corrected statement.

A. I knew very well that such an agreement did exist and that we discussed it, and I thought it was in that agreement which you just handed me.

Mr. Garrison: That is all, sir.

Recross-examination.

By Mr. Kremer:

R. X Q. 179. Did you ever see a copy of that agreement?

The Court: What do you mean, exhibit 1?

Mr. Kremer: No, the one he has just referred to.

Mr. Garrison: He said he thought it was in this one.

A. I said I thought it was in this one.

Mr. Kremer: Now, I say did you ever see a copy of this agreement?

The Court: The one he has just referred to?

Mr. Garrison: This is the one he just referred to and he said he thought it was in that.

2348 The Court: Make a proper objection.

Mr. Garrison: My objection is he did not say——

Mr. Kremer:

R. X Q. 180. Did you ever see a copy of that agreement about expenses?

A. No, I don't think I did. I thought it was in that agreement (Exhibit 1).

Mr. Kremer: But you were mistaken, were you not?

A. I certainly was.

R. X Q. 181. And you are positive you never saw a copy of such an agreement?

A. I don't recollect seeing such an agreement.

Mr. Kremer: That is all.

The Witness: I don't recollect seeing such an agreement.

Mr. Kremer: I heard what you said.

Witness excused.

Mr. Garrison: Now, I desire to offer in evidence the third annual report of the Butte & Superior Copper Company, Limited, for the year ended December 31st, 1914. As this is a very long document and there are a great many figures and pages of maps that are useless and there is only one paragraph that is useful, I desire to read that one in evidence.

Mr. Kremer: We desire to know what he is offering.

Mr. Garrison: As soon as we read it you will know.

2349 The Court: What is the offer, this whole report?

Mr. Garrison: If they insist. Otherwise, we would like to put in just the one paragraph.

Mr. Kremer: We would like to know what it is.

Mr. Garrison: (Handing counsel the book and pointing out a marked paragraph).

Mr. Kremer: No objection to it.

Book marked for identification and following paragraph admitted and read in evidence and marked Plaintiff's Exhibit 18.

Mr. Garrison: (Reading.) "The litigation in connection with the Minerals Separation, Limited, which, at the date of the last annual report was pending and undecided on appeal, in the United States Circuit Court of Appeals at San Francisco, has since that time been decided in favor of your company by the Court of Appeals holding the patents of the Minerals Separation Company Limited as absolutely void. This question has been taken to the Supreme Court of the United States, where it is now pending, and a decision cannot reasonably be expected before some time in the spring or summer of 1916. Your directors have no reason to modify to any extent the expressions in the last annual report regarding the final outcome of this litigation. Respectfully submitted, N. Bruce MacKelvie."

2350 Is it understood that this excerpt is all that now goes in evidence or simply the whole book received in evidence?

The Court: As far as the court understands it now you have offered only this paragraph.

Mr. Garrison: Is it conceded that the litigation there referred to is the case of Minerals Separation Company against James M. Hyde?

Mr. Kremer: I am sure I do not know.

HENRY D. WILLIAMS called as a witness in behalf of the plaintiff, being first duly sworn, testified as follows:

Direct examination.

By Mr. Garrison:

Q. 1. Mr. Williams, you are the general attorney or counsel of the Minerals Separation, Limited, are you not?

A. I am.

Q. 2. In the year 1914 what litigation had that company pending which was decided by the United States Circuit Court of Appeals at San Francisco?

A. The suit of Minerals Separation Limited against Hyde, which was carried on appeal to that court from this court.

Q. 3. Had it any case pending at that time other than the
2351 Hyde case against the Butte & Superior Copper Company Limited which was on appeal in the United States Circuit Court of Appeals at San Francisco and decided by that court?

A. No.

Cross-examination.

By Mr. Kremer:

X Q. 4. That is the same Hyde case that we have referred to here as having been decided by the Supreme Court of the United States?

A. Yes, sir.

X Q. 5. And at that time the Hyde case was upon appeal from a judgment of the Circuit Court of Appeals declaring the patents invalid, was it not?

A. Not on appeal, on writ of certiorari.

Mr. Kremer:

X Q. 6. Writ of certiorari?

A. Yes, sir.

X Q. 7. From a judgment declaring the patent invalid?

A. Declaring the patent in suit invalid.

X Q. 8. And that was the patent in this suit as well as the patent in that suit?

A. Right.

X Q. 9. Litigation was pending in this court was it not against the Butte & Superior Copper Company, Limited, upon the patent in suit?

A. It was then—That litigation was then pending.

Witness excused.

2352 Mr. Garrison: Now, there is no dispute, is there, that Mr. N. Bruce McKelvie was the president of the Butte & Superior Copper Company, Limited, is there, in the year 1914?

Mr. Kremer: No.

Mr. Garrison: Now, if your Honor pleases, we rest.

In view of something that your Honor said during the course of the hearing this morning, I was wondering whether your Honor intended to so shape the course of this trial that the defendant should

first meet the issues with respect to the alleged estoppel or bar or whether there was to be a general defense, and I thought if proper I would like to receive from your Honor an expression as to the future conduct of the case in that respect.

The Court: Well, I haven't given it any thought, to tell the truth.

Mr. Garrison: What is the disposition of the defense?

Mr. Kremer: The disposition of the defense would be to present its case in its own orderly way. The position that we take is that there is no estoppel or bar to meet, and the defendant shall proceed, after statement of counsel, of course with the consent of the court, to present its case in the orderly manner that it feels it should be presented in. We, of course, will be guided by our own desires in the matter, unless the court directs to the contrary. We naturally, like all attorneys, in arranging for the introduction of the defense
2353 or the introduction of testimony, have outlined a plan whereby we believe that the orderly presentation will be such that one can readily follow it through and will lighten the work of the court; and that, of course, we will do unless the court directs otherwise. I do not know that we need any direction as to how we would introduce our case unless it is with the direction of this court; we will proceed in what we consider an orderly manner.

The Court: What is your view of it?

Mr. Garrison: My view is simply this: That if it be a fact that some principle of law estops these defendants from raising certain questions upon this trial, it would seem to me that the orderly course of procedure would be the demonstration of that situation. We have produced our evidence with respect thereto. If they present their evidence with respect thereto, that issue is entirely different and separate from every other issue in the case, and upon the determination of that issue will depend the orderly conduct of the rest of the case. At the present time if your Honor now enters upon the full defense of this defendant, you will be met at every turn with the necessity of letting in testimony with respect to the validity, we will assume, of this patent or the character of an act of an infringement of this patent, all of which will be immaterial and irrelevant, and never should have been brought into the case. If it be a fact that this defendant is by a principle of law estopped from raising that defense or relitigating that or those questions it does seem to me that it is well worthy of consideration as to whether we
2354 may not lighten the burden of the court and counsel, litigants and witnesses by determining in limine—and the question in limine is "what is to be tried by me in this suit?" Now, if the issue is to be an entire, sole and complete defense, without bar or estoppel, that is one thing. If the issue is very much narrower than that, that is another. It does seem to me that the determination of that issue in advance would be of great benefit to the court.

Mr. Kremer: I assume that under the rule that your honor has repeatedly declared in this case on the rulings upon the disclaimer as well as to our objections to other matters introduced, that a ruling upon all of these matters as they are introduced would be such a ruling as would permit the record to be made for a higher court, no

matter what your honor's views might be as to them, but we of course will present our case in full and of course we assume that your honor would permit this method, no matter what your honor's views might ultimately be upon this or other questions, to go upon the record here for review by another court. And I will state that we have witnesses brought from a distance perhaps in connection with certain testimony that has here been introduced, that is to refute such testimony as has been introduced here as is capable of refutation. So we will proceed, under your honor's direction, with the orderly presentation of our case, and we submit to the direction of the court.

The Court: Of course it is obvious enough that if this case
2355 could be determined upon the question of estoppel, that it would shorten it very materially. If it was obvious, as I said before, that the estoppel existed, why the court would not hesitate to so rule. But the first question that met the court would be right now whether you have proven an estoppel, in other words, a former adjudication that estops these defendants. It is true the court might send the defendant to their proof, if they desired to submit any. They might not desire to submit any. They might rely upon the insufficiency, from their viewpoint, of the proof of estoppel. I would want to hear it argued pretty thoroughly before I would be prepared to say that you have established an estoppel. There is evidence that tends in that direction, but whether it is sufficiently clear and definite enough sufficiently certain "to a common intent" as they put it,—you say you have witnesses that are not here?

Mr. Kremer: That is what I meant by stating to your honor the other day that it was useless to take up the time of the court at present in arguing this matter.

The Court: What about your evidence in respect to that estoppel?

Mr. Kremer: I have no doubt that Mr. Garrison's statement——

The Court: What I have in mind is, is your evidence here and available, if you intend to use it?

Mr. Kremer: No, it is not. The question is whether we desire to use any or not use any. From this record as it is here sub-
2356 mitted, we contend that there is no estoppel shown. But if Mr. Hyde is available and I understand at this time that he is, a sharp issue will be then raised as to whether or not the statements here made are truthful. So we will proceed to make our statement, if your honor so desires.

The Court: Of course like in any other equity suit, if we proceed upon a record that might be fairly disputable and determine the question and let it go to the Circuit Court and possibly to the Supreme Court and comes back here for a new trial, I don't think it would be the best for either party or both parties. I imagine you are both anxious to have the record in such shape now that a final decision can be rendered in the upper court, in the appellate tribunal. I think it will make for a speedy conclusion of this case to allow the defendants to proceed at their discretion in the matter and the court will do so.

Mr. Garrison: I seek to reopen the closing of the case for the purpose of asking the defendant to produce from their New York or

Duluth or other office the various vouchers and other matters which are not in Basin or Butte and which are called for in my notice to produce.

The Court: Well, it should be done during the course of the trial, if the trial continues long enough to enable them to do it. If they can do it I assume they can by correspondence. You were late with your notice to produce, but they will do that if the case continues that long and I assume that it likely will.

2357 Mr. Garrison: We now close, with that reservation.

The Court: Let us first dispose of this proposed amendment to the answer. I find by examining it it proposes three publications not pleaded in the present answer if I remember right, two of which however are in evidence in the Hyde suit, the record of which is now in evidence here; and it also pleads perhaps some fifteen patents now in the present answer, one of which seems to be an Italian patent.

Mr. Scott: The Italian patent corresponds to this British patent, and that is referred to in the Hyde case.

The Court: This amendment,—of course amendments are always allowed in furtherance of justice at any time where it can be done consistent with the rights of the other party. It, too, comes late, of course. And yet there might be in the condition of all this litigation an excuse. If the court can take judicial knowledge of it, unreasonable delay and neglect should not be charged against the defendant in proffering this amendment. The question would be of course whether the plaintiff is prepared to meet it. What about it? If it operated as a surprise, there is a serious question which ought to involve its rejection. If it does not, the state of the case is such, and of these documents and of the proof available to you, that you can meet it, the court desires to know it and if that is not the situation the court desires to know it. You have made an objection simply based on lack of diligence as I recall it and on the

2358 estoppel.

Mr. Williams: On the estoppel, and not having then read the document, I find that there was an attempt to set up British application, which would be totally in violation of the statute, no application for a patent in England being of the slightest force and effect under the statute.

Mr. Kremer: Well, just disregard that. Where does that appear? It can be eliminated by consent. We will eliminate it by consent.

Mr. Williams: Lines 21, 22 and 23 of page 6.

The Court: Elmore British patent, 17816.

Mr. Williams: The words on these lines, "F. E. Elmore obtained British patent No. 17816 of the year 1904 for the same invention and that said Elmore applied by said British patent August 16, 1904." the entire statement to be eliminated. The British patent in question was sealed long after our application date and the application has no force and effect.

Mr. Kremer: We consent that it be eliminated—or I think more properly that we request that it be eliminated.

Mr. Williams: Again on page 5, the same words, constituting lines 17, 18 and 19.

Mr. Kremer: That may also be eliminated.

Mr. Williams: Now, in regard to a number of patents that are set up, really not any patent at all, but applications for United States letters patent, appearing on the last page of the proposed amendment to the answer, I wish to note the general objection that the only force and effect that these, when proved, can have is upon the question of originality in the identical invention of the patent in
2359 suit, and that that cannot in any manner be considered as part of the prior art. With that objection, now I see no reason why we should strike out the pleadings although as to the last patent in this list it appears that the date of application for United States letters patent was July 17th, 1906.

Mr. Kremer: Strike it out if you want to.

The Court: What is that?

Mr. Williams: F. E. Elmore, 826,411.

The Court: What was the date of the patent?

Mr. Williams: The date of application is July, 1905. The date of our invention is March, 1905.

Mr. Kremer: Strike it out.

Mr. Williams: And again on page 5 at line 16 the same patent, 826,411.

Mr. Kremer: That is the same.

The Court: That goes out?

Mr. Kremer: Yes.

Mr. Williams: Now, as to the California journal of technology, we do not plead surprise. We litigated a case in Wilmington, Delaware, wherein that was one of the defenses. We know of the existence of such a document. I don't know that we have come here prepared to meet it, but I believe we may be able to do so. The ground of our objection to that is that it is a new defense and the ground of objection is estoppel.

Mr. Kremer: Is that all, Mr. Williams?

Mr. Williams: That is all.

The Court: The objections will be overruled, as to the
2360 amendment to the answer, and the amendment will be filed.

Mr. Kremer: In conformity to the rule of court, I desire to submit an engrossed copy of the answer as made. That is the rule for the purpose of convenience. And I will ask permission to file this as soon as the amendments are made and it conforms to the matters stricken out by the court. That will be agreeable, and I will furnish you with a copy.

Mr. Garrison: Perfectly.

Whereupon the defendant made an opening statement to the court as follows:

Mr. Scott: This patent No. 835,120, your honor, here in suit has been sustained by the Supreme Court of the United States principally, if not wholly, upon the theory that there was what the court has referred to as a critical point. That has been the theory of all of the witnesses produced by this plaintiff from the beginning of this

case; it has been almost the sole reliance,—the principal reliance of plaintiff's counsel in all of their argument and presentations of this case. It was the theory upon which the Supreme Court of the United States has sustained this patent. And yesterday morning was the first instance in which we had seen this wonderful critical point repudiated by counsel for the plaintiff. While the Supreme Court was prevailed upon to accept this remarkable theory of a critical point in the matter of the amount of oil in this flotation process, we are compelled, in view of the character of the evidence and the character of the arguments made by counsel before the Supreme Court, to come here attacking the validity of this patent upon the theory
2361 that there is no critical point. So confident are we that the Supreme Court of the United States was misled by garbled evidence and arguments that misrepresented even that evidence, that we come here for the purpose of trying that issue of the validity of that patent once more. Now, there can be no question from the text of the opinion of the Supreme Court that the supposed existence of this critical point, so much emphasized by the witnesses for the plaintiff, and by the counsel for the plaintiff, was the foundation of the opinion by the Supreme Court. The fact that the Supreme Court declared claims 9, 10 and 11 invalid—the only three claims that did not specify this small amount of oil—is in itself convincing and conclusive proof that that was the foundation of their opinion. One of the closing expressions of the Supreme Court and one the meaning of which was invalidated in this disclaimer by having the passage taken from its proper context and put in another setting, is this: "The results obtained by the use of oil within the proportions often described in the testimony and in the claims as critical proportions, amounting to a fraction of one per cent on the ore."

Now, a "critical point," by every definition, popular, scientific or otherwise, is some point either in a physical change or in a mathematical conception where there is a transition, where one phenomenon changes to another. On this question the proposition has been advanced that when a certain point is reached in the reduction of oil we have the transition from a floating mass of mineral to a sinking mass, providing such quantity is being raised, or if we follow
2362 the procedure dwelt upon so fondly by the witnesses for the plaintiff, the sinking is changed to flotation by reducing the amount of oil.

Referring again to this disclaimer, not that I am going to discuss that, but to illustrate and make clear the line of evidence which we are going to introduce. The gist of the disclaimer is contained in one expression: "He hereby disclaims from claims 9, 10 and 11 of said letters patent No. 835,120 any process of concentrating powdered ores excepting where the results obtained are the results obtained by the use of oil in a quantity amounting to a fraction of one per cent on the ore." Now, it takes close attention from me to follow the refined argument upon which counsel for the plaintiff here baldly tells the court that they are not disclaiming anything but they are enlarging their patent by this disclaimer. The proposition advanced is that they are entitled to the results obtained by the use of less than

one per cent of oil, the implication being that if these results are obtained by the use of more than one per cent of oil they are still entitled to them. I think that is a fair statement of the idea that was put forth by them before this court. Now, that statement is absolutely inconsistent with any theory advanced by any one of the expert witnesses who have appeared for this plaintiff throughout this litigation. It is opposed to the decision of the Supreme Court and it is absolutely opposed to the representations made to the Supreme Court by counsel here present in their arguments which resulted in their patent being sustained. The very definition of the term "critical point" absolutely removes the possibility of this patent
2363 being valid and the owners of the patent still being entitled to something which is done by the use of an amount of oil larger than the "critical amount." The whole foundation of this patent, the very words of their own witness, Dr. Chandler, is based upon this amount of oil, the critical amount. So we will assume that there is a critical amount here; and in a day or two we will prove to the court that there is not. But, as far as that—as this case—has gone, we will say that there is a "critical point." This phenomenon does not come into play, there is no froth until the oil is below that "critical amount." That is the whole theory and foundation of the decree of the Supreme Court as to the supposed validity of this patent. And if that proposition isn't true, that patent isn't valid, and every court that this case has been presented to by plaintiff has been deceived.

The Court: What will you do in connection with this Supreme Court's decision?

Mr. Scott: I will explain that, how that comes about.

The Court: No, what shall we do?

Mr. Scott: We will present evidence here that was not before the Supreme Court, evidence which we conceive would have left no doubt in the mind of the Supreme Court as to the absolute invalidity of this patent. We will present evidence in this court that counsel for the plaintiff assured the Supreme Court in the most emphatic terms could not be produced. Counsel for this plaintiff assured the Supreme Court, and we did not have the evidence to meet it
2364 because this case was tried at so early a date, they assured the Supreme Court that any operation with over one per cent of oil was an impossibility, commercially, that it could not be done. They told the Supreme Court baldly that we, for the defendant, were there presenting tricks, shams, legerdemain; that we had done things in little machines on a bench that no man could duplicate in a mill, by which no man could concentrate ores and succeed; no one had concentrated ores in a mill with that large quantity of oil. And the evidence in the Hyde case was taken and the assumptions of these witnesses were accepted. And since these assumptions were made millions of tons of ore have been concentrated in the great mills of the United States with over one per cent of oil and in many instances showing even a greater efficiency, metallurgically, than previous operations with small amounts of oil. And we are convinced that it was assumptions of that character that led to the decision of the

Supreme Court. And we conceive that we do not come here in vain to try this case with a view to having it ultimately reach the Supreme Court; and we do not conceive that the Supreme Court, with evidence of that kind before it refuting the solemn assertions made by these counsel who are here and who were there, will ever adhere to the decision then made.

So inconsistent is the position of this plaintiff in this court with its position in the Supreme Court of the United States that they do not hesitate to absolutely deny and repudiate what they told the Supreme Court in attempting to sustain their patent when they come here with the fear in their hearts that somebody has made a suc-
2365 cessful process with over one per cent of oil. They told the Supreme Court, counsel here present, that their invention did not come into existence until you had below one half of one per cent. In answer to questions put by the court, by Mr. Justice McReynolds, where this invention came into being, counsel here present, in response to the question: "Do you have any invention at half of a per cent?" And counsel said, "It begins to appear remotely, but it begins to appear;" at three tenths of one per cent it increases, and at two tenths this great inventive child was fully delivered. And they come into this court repudiating this assertion. And so if somebody said this thing would appear at one per cent they could come in and say, "They infringe our patent," after having told the Supreme Court in precise terms that their patent could not be infringed if the operator used over one-half per cent, they were so afraid they were going to fail to put over their proposition that they even desired this one per cent amended in the patent and consequently said, "Give us one-half per cent and we are satisfied." Now, they come back here and want more than one per cent in a disclaimer which enlarges their patent.

But at the risk of repetition, I want to put one proposition again that I think I briefly stated. We have litigated here based upon the evidence of experts, based upon the arguments of counsel to the effect that there was a "critical point." Now, I think we should have in our minds a sharp definition of a "critical point." I think I may say that 32 degrees Fahrenheit is a "critical point." It is where water freezes. Now it freezes right at 32 or it wouldn't
2366 be a "critical point," if there was any variation about it. Pure water will freeze at 32 degrees Fahrenheit. Now, the Supreme Court mentioned this critical point. The Supreme Court did not say where it was, but they thought that a claim that merely called for a certain amount of oil was altogether too indefinite. That was like saying that water froze somewhere, some point; but they allowed this claim to be considered valid which called for a fraction of one per cent of oil; but the Supreme Court of the United States did not say that even one per cent was the "critical point." They avoided that. They said there was a critical point and in order to find out where that "critical point" was we look to the remarks of counsel, and they say somewhere at one half per cent, or below. But the proposition is it must be somewhere. And having put it there, to claim that anything infringes their patent above

that "critical point" is to say there is no "critical point," because if there is a "critical point" that is passed—that is placed where one phenomenon changes into another and if you can get that same result with a larger amount of oil then there is no critical point. The very definition of a "critical point" is this deciding at what particular point, with relation to the amount of oil, you come to a point—a line where the phenomenon changes. Now, when they say that if anybody gets this result with more than that amount of oil, they are admitting that there is no "critical point," that there is no point where the phenomenon changes.

Now, as to the proposition as to whether there is a "critical point" or not we shall produce evidence showing the absolute identity
2367 of these methods, identity in appearance, identity in metallurgical value and identity in the scientific and analytical explanation of their existence. We will show that in series such that no man can point out a critical line of demarcation between one phenomenon and another. Furthermore, we will show to the court that this Cattermole phenomena which I think perhaps the court remembers from the proceedings in the case some years ago, in which the mineral was caused to be sunk by a large amount of oil, the theory of this patent being that when you lessen the amount of oil that causes the metal to float instead of sink, as in this Cattermole process. We will take exactly the same mixture and will agitate it and cause it to float, and, without changing the mixture one iota we will cause it to sink, showing that oil has nothing to do with it. The whole theory of this case is a matter of manipulation, that it is merely a matter of how the thing is stirred up as to whether it sinks or floats. Not only that, but we will show the court, not only in experimental apparatus, but through the evidence of witnesses, we will show this court that commercial froths of greater metallurgical value are produced with larger amounts of oil, not only as great as this Cattermole process, but even greater.

The attempt made here to enlarge this patent by disclaimer, if one may use such a paradoxical expression, and it is the only correct expression, is emphasized throughout this record which is already before this court as a part of this case by stipulation, the Hyde case, and I refer to this because it will emphasize, I hope, in the
2368 mind of the court, the force of the evidence which we are going to produce. Their expert witness, Dr. Chandler, started out with the proposition that the reduction of this quantity of oil was the foundation of this invention. Now, when we show the same phenomenon with amounts 10, 20, 40 times as great as the highest item with which they themselves have put forth in their definition of the invention, how can we believe there is any invention here? The thing is inconceivable. They had their chance as to how to define this invention. There was their patent. They put the facts and the evidence around it, and we go outside of these matters and find the same thing in the prior art. Dr. Leibmann has referred to the amount of the oil as "infinitesimal" and as "microscopic" and yet we have the plaintiff here in this very suit validating its patent so that it has a right in court by filing a disclaimer; which according

to their confessed intention is not to comply with the Supreme Court and narrow their patent, but which, according to their statement made in court, is for the purpose of enlarging it beyond the thought even of the patent solicitor who drew it years ago or beyond the fond vision of the inventor. They now desire to include operations such as are today being carried on at the Butte & Superior Mining Company with amounts of oil greater than one per cent. The patent itself defines the amount as less than 1%. The Supreme Court has handed down an opinion, a decree based upon the very idea that the patent is confined to one per cent, and has declared three claims invalid upon that theory, and they come into this court to
2369 maintain their standing in court, as they must, by filing a disclaimer, by which disclaimer instead of containing the patent within its proper bounds, by the very admission and claims of counsel, is intending not to comply with but to deceive the Supreme Court. The Supreme Court has said your patent is restricted, and they say now, "Your honor, you meant to widen it despite your express statement to the contrary. Dr. Liebmann has said there was no froth over one per cent. With years of study this patentee, with all of these experts, say there is no froth over one per cent. And yet, if we make a froth with over one per cent they say "we invented that ten years ago."

A great deal is being made in this case by the plaintiff of the decree of the Supreme Court. I think I am entitled to show this court what kind of representations that decree was founded on. These are the representations made in arguing to the Supreme Court of the United States.

The Court: I don't think we should go into that.

Mr. Scott: Must we accept the decree without the admissions that were solemnly made in court as the basis of that decree?

The Court: I think that decree is binding upon the same set of facts anywhere.

Mr. Scott: But, for the meaning of the decree. The decree—there is no question as to the decree being binding upon the same state of facts. We are not going to present the same state of facts.

The Court: I understand.

Mr. Scott: We will present a different state of facts and
2370 presenting that different state of facts, we think we should be allowed to show the record upon which——

The Court: If it should be when offering it then we will take it up and discuss it. I do not think it comes in the way of an opening statement by counsel.

Mr. Scott: There is one point more that I wish to make in connection with the alleged disclaimer. There are two ways—I will take the liberty of explaining, although it may be familiar to the court—of changing a patent after it is issued. One is by a disclaimer, with which the court has become quite familiar in the last two days. The disclaimer is simply a way of amputating something from the patent, cutting something out of it; and the other way is by reissue. If the patentee through inadvertence, accident or mistake has claimed more than he is entitled to or has made some error,

he is allowed to surrender his patent to the Commissioner of Patents and to apply for a reissue. Now, having done so, the Patent Office examines the patent over again in its entirety. They can take away from him that which he had in his first patent if they want to. And in case the patent is reissued there are no rights antedating the date of the reissue. Everything in the past is wiped out. He can collect nothing for damages for infringement prior to the granting of the reissue; and the reissue expires on the same date that the original patent would have expired on. Furthermore, we will assume that the patentee has not claimed his invention as broadly as he was entitled to and wants to reissue it in order to broaden his
2371 claim to include something that it would not have included in its original form. Now, if it so happens that before he applies for his reissue some third party, some member of the public actually manufactures this article or practices this process which he wants to include by broadening his claim, he is not permitted to do so unless he has filed his application before that member of the public does manufacture that article, or practices that process. If he does not apply for his reissue until after some member of the public has manufactured the article or carried out the process which he wishes to include, he is precluded from getting a reissue by what is termed "the intervening rights" of this member of the public. Now, in this matter of disclaimer the patentee meets no such obstacle. The very theory of the disclaimer is that he is giving something back to the public; therefore, there can be no intervening rights. At most he is giving the public something, and there is no possibility of the patentee taking more from the public than his original patent took. He is giving them some of his monopoly. In the second place, the procedure by disclaimer avoids a re-examination of the patent by the patent office. The patentee simply draws up this paper and files it in the patent office; no one looks at it, his patent is not examined because the theory of the thing is he is giving something up and he can be trusted to do that. Now, in this particular case here before the court, assume that the patent in this particular was not as broad as they wanted it to be, and that is what they have said already, that it was not; they want more than one per cent now. Their proper procedure would have been to apply for a reissue of
2372 their patent if they wanted to broaden it. It is the only procedure by which one can properly broaden a patent. But why was it objectionable to them to proceed by application for reissue? First, that at the time they filed their disclaimer thousands of tons of ore were being treated by the flotation process every day with over one per cent of oil. The intervening rights would have prevented any possibility of their getting a reissue. Second, the great lapse of time since they took their patent out, over ten years ago, would have been sufficient to prevent it. And, third, had they applied for a reissue the probability is that the patent office would have taken their whole patent away from them because the evidence which we shall present to this court will show that there was—we shall present to this court will show plainly that there is no boundary to this "critical point," and immediately you go beyond the one per cent and the "critical point," we arrive in the realm of the prior art.

Now, if there is still time this afternoon I propose to examine at least one witness.

Mr. Kremer: We might save time by proceeding with some matters. Perhaps we can take up——

The Court: Proceed at your discretion.

Mr. Kremer: We will ask Mr. Ballot to be sworn.

2373 JOHN BALLOT, called as a witness in behalf of the defendant, being first duly sworn, testified as follows:

Direct examination.

By Mr. Kremer:

Q. 1. What, if any, position do you hold with Minerals Separation, Limited?

A. Chairman.

Q. 2. Chairman of the board of directors?

A. Yes.

Q. 3. What, if any, official position do you hold with a corporation known as Minerals Separation North American Corporation?

A. President.

Q. 4. What, if any, interest has Minerals Separation Northern American Corporation in the patent in suit?

A. They acquired the interests of the patent——

Mr. Garrison: That is expressed by writing which we will produce if they wish it.

Mr. Kremer: It is immaterial to me how it is proven.

Mr. Garrison: We will produce all of the matters which have to do with the North American Corporation and Minerals Separation, Limited.

The Court: Is that satisfactory?

Mr. Williams: They are not in my possession now, they will be in my possession this evening.

Mr. Garrison: We sent for them to New York.

Mr. Williams: They are coming from New York. It takes three days.

2374 Mr. Kremer: I think this question is proper.

The Court: He may answer.

Q. 5. What if any interest has Minerals Separation North American Corporation, in the patent in suit?

A. They acquired the interest of the patent.

Q. 6. What else?

A. They own the interest in the patent.

Q. 7. They own the interest in suit?

A. They do not own it in this sense, that it has been transferred to them, but they have acquired the rights to the patent.

Q. 8. The American rights to the patent?

A. The American rights.

Q. 9. Then, as I understand you, Minerals Separation North American Corporation, own the American rights to patent No. 835,-120, the patent in suit?

A. They do.

Q. 10. When did they acquire the American rights?

A. December 7th of last year.

Q. 11. December 7th, 1916?

A. But no transfer has taken place of the patent. The parent company retains it as a trustee for the American corporation until this litigation is finished.

Q. 12. Minerals Separation, Limited, then, is only the trustee?

A. The registered owner.

Q. 13. For Minerals Separation North American Corporation?

A. And registered owner.

2375 Q. 14. But in fact Minerals Separation Limited own no American rights; Minerals Separation North American Corporation, owns those rights?

A. The beneficial rights.

Q. 15. Under the laws of what state is Minerals Separation North American Corporation, incorporated?

A. Maryland.

Q. 16. To refresh your memory, is it not a fact that all of the stock of Minerals Separation North American Corporation was issued in payment for the American rights to certain patents including the patent in suit, 835,120?

A. That is so.

Q. 17. That is the fact?

A. Yes.

Q. 18. And that issue of the stock was made when?

A. December 7th, 1916.

Q. 19. I present to you a copy of the Mining and Engineering World, of date December 30th, 1916, and turn to page 12 of that journal, and I ask you to state if, as president of Minerals Separation North American Corporation, you recognize that advertisement?

Mr. Garrison: I don't understand exactly the question, but I don't think it is worth while to object. If he means that they are responsible for the advertisement, that is another thing.

Mr. Kremer: I can not ask that until he looks at it. He might say he never saw it before in his life.

Mr. Garrison: You can ask him the direct question.

2376 Q. 20. (Last question read.) Q. Do you recognize that advertisement as one that you had ordered inserted in that journal?

Mr. Garrison: With that addition I have no objection.

A. Yes, we are responsible for it.

Mr. Kremer: We offer in evidence page 12 of the Mining and Engineering World, of date December 30th, 1916.

Mr. Garrison: That is objected to as incompetent and irrelevant to any issue in this suit.

The Court: What is the object, Mr. Kremer?

Mr. Kremer: It is in connection with our argument that the disclaimer—and is evidence of unreasonable delay, in this: under the question of law presented to the court and argued solely as a question of law, there was considered only the question of unreasonable delay per se. There was no evidence showing the attitude of the holder of the patent at that time insofar as the public is concerned, in holding itself out as the owner of a valid patent. We offer this testimony, and I will offer other testimony of this character, for the purpose of showing that, under the circumstances of this case the delay of over 100 days, or 74 days, if you so choose to interpret it, was an unreasonable delay under the conditions, because the whole industry of mining in this country was laboring under the belief of the truthfulness of the representation that the owner of the patent was making throughout the length and breadth of the land—

2377 under the belief in that truthfulness—and if we can establish this fact, that these representations were being made, then there is positive evidence of the reason of their delay, and there is positive evidence of the fact that they were profiting by their unreasonable delay, and were practicing deception upon the public. What might be reasonable delay under one state of facts, becomes a most unreasonable delay under another state of facts, and this is a part of the chain of evidence, showing why this delay was unreasonable. Their patent was absolutely void through this whole period, because there had been no disclaimer filed, and that statement is borne out by the admissions here. It could only be cured by the filing of a disclaimer without unreasonable neglect and delay. Now, that is the purpose of this testimony, that is, the testimony of these advertisements. Of course it must immediately become apparent to your honor that the question with reference to Minerals Separation North American Corporation, presents still another question, which is not concerned.

Mr. Williams: I might give you notice now, Mr. Kremer, that if we can prepare this evening, a supplemental bill of complaint, bringing in Minerals Separation North American Corporation, as a party plaintiff, upon the arrival of the train this evening, we will present such a bill tomorrow, but it may not be physically possible to do it.

Mr. Kremer: Of course the evils of the day are sufficient.

2378 Mr. Williams: I will read the advertisement: "The flotation process. All rights under this process in North America are now controlled by Minerals Separation North American Corporation. The Supreme Court of the United States having established the validity of the basic patent, for froth flotation, notice is given that the company is ready to grant licenses for the use of this process to those who wish to install and use it. To those who have infringed the patent, notice is given that a settlement for past infringement must precede the granting of license for the future use of the process. Notice is also given that the company will enforce its patents, and will stop all infringement." Then follows a statement

about maintaining a laboratory where ores will be tested at minimum expense for prospective licensees. That is the substance of the advertisement.

The Court: Well, under the rule and promise of counsel that he has other evidence which, taken altogether, he believes will establish unreasonable neglect and delay, the objection will be overruled and the advertisement may go in. If it is not entitled to any weight when the court comes to render its decision, it will be given none.

Plaintiff excepted.

Advertisement contained in Mining and Engineering World, December 30th, page 12, is admitted in evidence marked defendant's exhibit No. 19.

Mr. Kremer: I will offer another.

2379 Mr. Garrison: We will present that to Mr. Ballot, and if he says he authorized that, we will admit it.

By Mr. Garrison:

Q. 21. Was this authorized by you or your company?

A. Yes, sir.

Mr. Kremer: This is in the Engineering and Mining Journal of date December 23rd, 1916, page 35. It is——

Mr. Garrison: It is admitted by counsel for the plaintiff that this advertisement was inserted by authority of Minerals Separation North American Corporation.

Mr. Kremer: We offer it in evidence.

Mr. Garrison: We make the same objection.

Objection overruled; plaintiff excepted.

Copy of Engineering & Mining Journal, of date December 23d, 1916, page 35, marked Defendant's Exhibit No. 20 and admitted in evidence.

Mr. Kremer: I offer in evidence a similar advertisement included in the Salt Lake Mining Review, of date January 15th, 1917, page 55 of that paper.

Mr. Garrison: We make the same objection.

Objection overruled; plaintiff excepted.

Page 55 of the Salt Lake Mining Review, of date January 15th, 1917, marked defendant's exhibit No. 21 and admitted in evidence.

2380 Mr. Kremer: I offer in evidence a similar advertisement appearing in the Mining & Scientific Press, of date January 6th, 1917, being upon page 15.

Mr. Garrison: The same objection.

Objection overruled; plaintiff excepted.

Page 15 of the Mining & Scientific Press of January 6, 1917, marked Defendant's Exhibit No. 22 and admitted in evidence.

Q. 22. Mr. Ballot, approximately in how many journals, mining and engineering journals, did you cause that publication to be made?

A. Well, I cannot tell you that from memory.
Q. 23. Were there a great number or only a few?
A. Maybe six and maybe more, I would not say.
Q. 24. Over what period of time did that advertisement run?
A. I could not say.
Q. 25. Approximately.
A. Probably a month or two.
Q. 26. During the months of December, January and February, would you say?
A. I cannot answer exactly; probably December and January—maybe two months, and extending into the following month.
Q. 27. Did you run it into February?
A. Very possibly.
Q. 28. Did you cause the publication to be run in any financial papers?
2381 A. It depends on what you call financial papers. If you name the papers to me, possibly I could remember.
Q. 29. For instance, the Boston News Bureau?
A. Yes, I think so.
Q. 30. Did you cause that to be run during the month of February, 1917?
A. Yes, and probably longer.
Q. 31. I present you with a copy of the Boston News Bureau, of date February 21st, 1917, on page 10, and I will ask you if you caused that advertisement to be inserted.
A. I think so, yes, sir.

Mr. Williams: We will admit that we did. It is the same advertisement.
Mr. Kremer: We offer in evidence the advertisement appearing on page 10 of the Boston News Bureau of date February 21st, 1917.
Mr. Williams: The same objection, your honor.

Objection overruled; plaintiff excepted.
Boston News Bureau, of date February 21st, 1917, page 10, marked Defendant's Exhibit No. 23 and admitted in evidence.

Q. 32. Did you cause an advertisement to be run in the New York Commercial—I hand you one dated December 15th, 1917.
A. Yes, sir.

Mr. Williams: We will admit that the company authorized
2382 the publication of this reading notice in the New York Commercial, which is in fact and in substance, an advertisement.
Mr. Kremer: We offer in evidence page 14 of the New York Commercial, of date January 15th, 1917.
Mr. Williams: The same objection by the plaintiff.

Objection overruled; plaintiff excepted.
Page 14 of New York Commercial of January 15th, 1917, marked Defendant's Exhibit No. 24, and admitted in evidence.

Mr. Kremer: I don't like to offer a letter of counsel. Will you

admit that copies of this letter were sent to various people at the instance of the plaintiff?

Mr. Williams: Yes, certainly. I did this as counsel for Minerals Separation, Limited, and Minerals Separation North American Corporation.

Mr. Kremer: I offer in evidence a letter written by Henry D. Williams, dated January 30th, 1917, under the statement just made by Mr. Williams that he did it as counsel and at the instance of Minerals Separation, Limited, and Minerals Separation North American Corporation——

Mr. Williams: That is right.

Mr. Kremer: And that this letter was sent as a notice of infringement and claim of right. Is that correct?

Mr. Williams: Yes. But I object to it on the ground that it is incompetent, irrelevant and immaterial as to any issue in this case.

Objection overruled. Plaintiff excepted.

2383 Mr. Kremer: Attached to the letter was a copy of the opinion of the Supreme Court, and the other documents described in the letter. We offer those also.

Mr. Williams: The same objection.

The Court: Objection overruled.

Plaintiff excepted.

Letter of Mr. Williams dated January 30th, 1917, admitted in evidence and marked Defendant's Exhibit 25.

Mr. Kremer: For the sake of brevity, will you not agree that similar letters and similar statements with similar enclosures were sent to a great number of mine and mill operators in the United States during the months of January, February, March and April, 1917?

Mr. Williams: That is rather indefinite. If you will omit the word "great" I will accept it.

Mr. Kremer: Will you substitute the number, Mr. Williams; I will call on you for that information, and your statements, off the stand, is all that we desire.

Mr. Williams: I would say that, having learned that there were something in the neighborhood of 200 mines infringing the patent, we sent these notices to those mines. I think possibly the number exceeded 200, but that is the best of my knowledge and I will stipulate in the neighborhood of 200.

Mr. Kremer: During the months that you mentioned, January, February and March, we will say?

Mr. Williams: Yes, but not April.

Mr. Kremer: Yes, I have got one in April.

2384 Mr. Williams: Have you? I see. And April, yes.

Mr. Kremer: I think that covers that feature of the matter.

The Court: Very well, proceed.

Mr. Kremer: I have engrossed the answer, under the rules, that where the amendment is offered it should be inserted in the original answer. I present a copy to counsel for the plaintiff. The document

presented is the answer with the amendment included. Of course it does not include the supplemental answer, which I take to be a separate document, and did not engross it with the other. However, I have here a copy of that answer, and I offer this at this time, and ask that it be filed. Of course if counsel finds any error in it——

Mr. Williams: Subject to correction it may be filed.

Mr. Kremer: That may apply to both of us. Subject to correction for error, of course.

Mr. Williams: Yes.

The Court: It may be filed.

FRANK R. WICKS, called as a witness in behalf of the defendant, being first duly sworn, testified as follows:

Direct examination.

By Mr. Scott:

Q. 1. State your full name, please?

A. Frank R. Wicks.

2385 Q. 2. What position do you hold at present?

A. I am at present assistant superintendent of mills for the Chino Copper Company.

Q. 3. Located where?

A. At Hurley, New Mexico.

Q. 4. What experience have you had in a general way in the duties of the kind you now perform?

A. I have been associated with milling and metallurgical companies for about twelve years.

Q. 5. And in a general way your duties are of what character?

A. During the first two years my duties were entirely clerical and mechanical. During the next five years they were both mechanical and metallurgical, because our organizations at that time were not very extensive. In the next three years I had supervision over mill operation, embracing all the departments of milling, and the same is true, though with a different company, in the last two years, which makes up the whole twelve years.

Q. 6. Have they a flotation plant in the mill where you are now engaged?

A. Yes, sir.

Q. 7. Are you familiar with the operation of that flotation plant?

A. Yes, sir.

Q. 8. Have you operated or had that plant operated under different conditions as to quantities of oil or other reagent ordinarily termed oil?

2386 A. Under a number of different conditions.

Q. 9 How do the results compare, with different quantities of oil?

Mr. Williams: I object, your honor, to this testimony, first for the reason that having proved that an estoppel exists, that this defendant has had its day in court; that no evidence tending to show what can

be done in the flotation operation, other than that of the defendant, and other than those that are within the issues in this case, is of any relevancy whatsoever. I make that the first objection.

Further, the Supreme Court of the United States having decided that our patent is a valid patent for a patentable invention, any attempt whatever to alter or attack the facts found by the Supreme Court, under the doctrine of stare decisis, is irrelevant and immaterial. The decision of the Supreme Court of the United States applies to the fact that we have proved, establishing the infringement, because we have proved that this defendant has done just what Hyde did; and that this defendant did that before the commencement of this suit and after the issuance of our patent; therefore the facts in this case are the facts of the Hyde case, and upon those facts the Supreme Court of the United States has held that the patent is valid and infringed, and any testimony attacking the validity or the patentability of the novelty of the invention is an attempt to alter the state of the law as to the state of the facts which is before this court. The Supreme Court has held that under the state of the art the invention was patentable, and the Supreme Court of
2387 the United States and the general law—the general patent law—is not concerned with things that have happened since the invention. Of what possible force and effect can the operations of the Chino Copper Company be in determining novelty? Because they are not of a prior art at all; they are within the last few months or years. We are dealing here with an invention that was made in 1905.

The third ground is that this is not evidence of anything that has the slightest bearing upon the novelty of the invention, the Supreme Court having decided as to the novelty and patentability of the invention.

Mr. Scott: I think I have explained our position very fully in my opening, that the testimony which the witness is about to give is directed to the simple issue as to whether this patent affirms the truth in stating that a new phenomenon occurs and a new invention has been made when the quantity of oil is decreased below a certain amount, and I will perhaps elicit from the witness the truth regarding the effect of doing these things and doing them upon a milling scale. His testimony in that aspect would be similar to that of an expert who came in with the result of a laboratory experiment. The fact that his testimony will concern the operations in a mill, only renders it more relevant.

As to the Supreme Court having decided that this patent is valid upon the prior art, the Supreme Court did decide this case upon the prior art that was before the court; but there will be additional prior arts before this court and additional evidence before this court.
2388 Mr. Williams: There is not yet.

Mr. Scott: The evidence is now being given.

Mr. Garrison: I only want to emphasize one point. It seems to me very clear that, the Supreme Court having decided, beyond the possibility of any doubt, that in the then state of the art this discovery was patentable, that any testimony as to what is done

now—not under any prior art—with respect to flotation at Chino or any place else, is absolutely negligible, and immaterial and irrelevant.

The Court: Apart from the claim of estoppel, is not the issue open to trial, just the same as though the Hyde case did not exist, and the Supreme Court decision did not exist?

Mr. Garrison: I cannot answer that categorically. I will answer yes and no. My opinion is this: Say we had a case of a will that was attacked in a suit for ejectment, we will say, between Jones and Smith, and the testimony was taken with respect to the testamentary capacity of the testator, and the case went to the Supreme Court of the state or the United States—the controlling court, and they held that with respect to the facts before them as to transactions with the testator prior to the making of the will they were satisfied that the will should stand, and that with respect to statements made by the testator after he had made the will, they were negligible and inadmissible. Now, we have another litigation in which the same will is brought forward between entirely different parties. We are not contending for one moment that it is not absolutely proper in
2389 our suppositious case, to bring in everything that is relevant, which the controlling court has determined that is relevant, and everything that has to do with the then state of the art, at the time these people made their invention. Everything of that kind is relevant and material, but what occurred afterwards is not material. In our suppositious case, if any statement made by the testator before he made his will bears upon the question and is relevant and should be weighed and determined, and if new facts come forward of that kind they should be received and considered; but having once decided that the will should stand or fall by what could be proven that the man said or did prior to its making, and not after its making, that is the law of the case, and whenever that will comes up, every court should apply that law—that rule of evidence. It is relevant concerning that subject matter.

Now, we, in our own case, after the most careful consideration of the state of the art, have proven it before the court, which of course we cannot vary here. We do not maintain that it is not absolutely relevant for them to prove anything in that line—barring the estoppel—anything concerning the state of the art on which to base the claim that it is not an invention. When the Supreme Court said we are right, and applied the correct rule of law, namely, what was the state of the art at the time this invention was made—they found that at that time this invention was patentable. Now, to go forward and say they are going to vary that by showing what has happened since by using a greater quantity of oil or a less quantity
of oil, can not affect this question. The Supreme Court said
2390 that in the then state of the art it was an invention, and we believe, even though you specify the amount of oil in their patent—they said you have a valid patent for that in the then state of the art. Now, is it possible that they should be allowed to bring testimony to vary that by anything that has happened after

the time of the discovery and the time at which the Supreme Court determined that at that time it was a discoverable invention?

The Court: There are lots of cases on that point, probably. Has not that issue been up many times?

Mr. Garrison: In one way it could not have come up before, and in another way it may have been up many times. I am arguing apart from the question of estoppel, that that is the law of this case. We have to take the state of the art which the Supreme Court have used and they said "Under the then state of the art this was a patentable invention." I suffer somewhat under the same disability that your honor mentioned yesterday, of not knowing very much about patent office terms. They said "We determine that in the then state of the art that this was a patentable discovery." How can they possibly be permitted to put in testimony as to what can be done with greater quantities of oils or less quantities of oils or different quantities of oils subsequent to the date of that decision.

The Court: It looks as if it ought to be so. The question is whether it is so.

Mr. Garrison: I am arguing that it is so, and I leave it to your honor to say whether it is so. Mr. Scott says frankly that
2391 this is all the evidence that he has got, but he is going to bring a vast amount of testimony as to what can be done by varying the quantities of oil, by the use even of vast quantities of oil.

The Court: He wants to show by new evidence and by inferences drawn from the former evidence that the conclusions arrived at were wrong .

Mr. Garrison: The Supreme Court reviewed the former evidence, and reached a conclusion that this discovery was novel, in the then state of the art. They say "We find that at the time the people made this discovery that the state of the art was such that this invention was discoverable.

The Court: Not what might have been done there, but the state of the art? Well, there must be cases. It seems to me that that issue ought to have been up in many cases.

Mr. Scott: I don't think, in our view of the matter, that it is a question that requires citations. This witness who testified yesterday, it is exactly the same as any expert witness who would say I made an experiment last night. This experiment which this witness will testify about happens to have been made in a mill. Furthermore, the laws of nature are the same now as they were in 1905. We brought the results of experiments here with different quantities of oil in the Hyde case, and we were criticised because we did not have results of experiment in a mill. Now we have done it in a mill, and they still criticise, and when we have used larger—now we have done it in a mill and still they criticise, though we
2392 have used a larger quantity of oil. As to the prior state of the art, we are merely saying that what there was in the prior art, unknown to the Supreme Court, we should be allowed to show. What we desire to show is what can be done in a mill and what was done in a mill which this witness will testify about, and it is strictly connected with the prior art .

Mr. Garrison: They have not qualified him to testify about the prior art.

The Court: I know, but they want him to show by his testimony that what he has done now to strengthen their statement, that that was the prior state of the art, or that it could have been done under the prior art.

Mr. Garrison: I am perfectly fair with the court. I don't want any ruling to be made under a misunderstanding.

The Court: Certainly. We want this case tried so it will not come back.

Mr. Garrison: If Mr. Scott had proceeded with his witness, showing that they had done this or that at Chino or elsewhere with the amount of oil larger or different from those under our patent, that would be different. He has not done that. He has produced a gentleman who says he is from Chino, and that his mill has experimented with different quantities of oil. There is not a scintilla of testimony to show that it is under any prior art, and until that is shown, it seems to me that your honor is embarking on an immense field, which is not relevant. I think Mr. Scott should demonstrate first under what conditions of the prior art this Chino
2393 experiment comes, and have the horse in the proper place, before the cart, not after it.

Mr. Scott: I think the court can trust us to connect up our testimony. This witness knows about the matters about which we are talking.

The Court: Has the Supreme Court, in a case to which this defendant is a stranger, rendered an opinion—does that opinion establish the validity of that invention and the prior state of the art or the state of the prior art, so that it binds this defendant and other persons who want to litigate this patent.

Mr. Garrison: Provided nothing is added to the prior state of the art—yes, I can assert that.

The Court: Then I would like to hear cases, because if it is the fact, I think it will materially shorten this case. I will give you until tomorrow morning to present cases.

Whereupon an adjournment was taken until Wednesday, April 18, 1917, at 10:00 a. m.

2394 Wednesday, April 18, 1917—10:00 a. m.

Trial resumed pursuant to adjournment, all parties present; whereupon the following proceedings were had:

Mr. Garrison: The precise question under consideration at the hour of adjournment was whether a question addressed by Mr. Scott to the witness, Mr. Wicks, was, in view of the issues in this case and its present condition to be admitted. Mr. Wicks stated that for some twelve years he had been engaged in the business of mining and milling, and that for some five or six years he had been at a plant in New Mexico at the Chino Company. He was asked by Mr. Scott the following question: "Have you operated or had that plant

operated under different conditions as to quantities of oil or other reagent ordinarily termed oil. A. Under a number of different conditions. Q. How do the results compare with different quantities of oil?"

And to that objection was made.

Your honor will recall that in the opening Mr. Scott very candidly and very clearly set forth what they proposed to prove in this case, and tendered this as his first witness to prove that which in his opening he stated they were going to prove. For the purpose of accuracy let us see just what issue Mr. Scott has tendered in this case, and the only issue. He says on page 190 of the transcript of testimony: "So inconsistent is the position of this plaintiff in this court with its position in the Supreme Court of the United States, that they do not hesitate to absolutely deny and repudiate what they told the Supreme Court, and in attempting to sustain their
2395 patent, when they come here with the fear in their hearts that somebody has made a successful process with over one per cent of oil."

On page 193 he makes it still plainer and says:

"The whole theory of this case (speaking of his own theory) is a matter of manipulation as to how the matter is stirred up, as to whether it sinks or floats. Not only that, but we will show the court, not only in experimental apparatus, but through the evidence of witnesses—we will show this court that commercial froths of greater metallurgical value are produced with larger amounts of oil."

He makes it equally plain on page 196, by saying:

"I think I am entitled to show this court what kind of misrepresentations that decree was founded upon."

So we have a perfectly candid opening. There is not a single proffer of proof in the opening with respect to the state of the art, not one scintilla of statement of the smallest microscopic quanity. He says, "We are going here to proffer proof that the results of the process in suit can now, we have discovered, be obtained by the use of greater amounts of oil."

Now, my contention yesterday, and the one for which your honor asked me to procure authorities was this: That where a court is determining the question of invention, it must look solely to the state of the art at the time the discovery was made; at the time the invention was discovered; and its patentability or lack of patentability depends solely and absolutely upon what the court finds the state of the art to have been at that time. That proposition is
2396 so well settled that I doubt if it requires any citation of authority; if it does I can produce the authority.

My next proposition was that where a patent had gone to the Supreme Court of the United States, and that court, with respect to the then state of the art disclosed to it, had decided as a matter of law that invention was present, and patentability was justified—that decree—that finding binds all courts in this country upon the question of law, and binds all courts in this country upon the same state

of facts, irrespective of who the party to the initial or subsequent litigation is; that is fully vindicated by authority.

The principle has even gone deeper and in the District and Circuit Courts of the United States wherever a patent has been investigated by any one of such courts and a subsequent trial between different parties discloses the same state of facts, the ruling will be the same. We find, rather remarkably, that this has even been raised and decided by a plea in McCloskey v. Hamill, 15 Fed. Rep. 750, Cir. Ct. Southern District of New York, February 19th, 1883. This is a bill in equity, recites the alleged infringement of letters patent No. 220,767. "This patent has twice been the subject of examination by Judge Wheeler in the Circuit Court for this district, McCloskey v. Dubois, and McCloskey v. Dubois and others. The facts which the plaintiff proved upon the second hearing are the same which he relies upon in this case. Judge Wheeler's opinion was that the alleged invention, which is the subject of this patent, is not patentable. That must be taken to be the law of this circuit until either a state of facts is proven which shall present a
2397 different case or until the conclusion of law upon the facts as now shown shall be overruled by the Supreme Court." The plea is sustained.

In the case of Green v. City of Lynn, 57 Fed. Rep. 516, 518, Circuit Court District of Mass., April 17th, 1893, Putnam, Circuit Judge. "Of course the findings of the Supreme Court in Andrews v. Hovey on questions of law are conclusive on all of the courts. The same is true as to its findings of fact, with reference to any other cause in which the court perceives that the facts are substantially the same as those which came before the Supreme Court. The reasons for this need not be elaborated, but this distinction is to be noted: That, when the parties are not the same in each case the determination of issues of fact by the Supreme Court do not operate strictly as res adjudicata or as a technical estoppel, but merely upon the conscience of the inferior tribunal."

And in Beach v. Hobbs, 82 Fed Rep., 916, Cir. Ct. District Mass., August 23d, 1897, Putnam Circuit Judge, says: "A decision by the Circuit Court of Appeals in any circuit, so long as it remains unappealed from, and so long as the Supreme Court has issued no writ of certiorari to re-examine it, is to be regarded as having more effect in other federal courts than that ordinarily given to those of the highest state tribunal or other courts of merely concurrent jurisdiction. This is especially true with reference to a patent for an invention, when the state of the proof remains substantially the same. Yet, when the respondents are not the same, they are entitled
2398 to have the facts of their case carefully scrutinized whether or not they present a different case from that adjudicated in the trial or litigation."

So, we now have gotten, with this brief resume of the situation, the fact that this defendant has not in this case produced any proof, proffered any proof or indicated what proof they propose relying on as to the state of the art at the time of the invention of the patent in suit. And yet they are proffering the testimony with respect to

processes which, under the opening, can only have one course attributed to them, and that an immaterial, irrelevant and utterly incompetent issue to be tried in this suit.

Let us assume that they produce from Chino, from Ray, from Inspiration, from any other plant over which they have any authority to exercise control or with which they have any influence to produce witnesses, that they are by some process now, today, producing ore flotation with a greater amount of oil than that specified in the patent in suit. What of it? How is it relevant? How is it material? How can it possibly be taken into consideration by your honor in deciding any issue that is now before you or that can be brought before you under these pleadings?

Under the opening in this case, he stated that he proposed demonstrating to your honor that the Supreme Court of the United States had been deceived in the Hyde suit. I do not know to what he attributed the errancy of the District Court of the District of Montana who fell into the same error. I do not know whether he
2399 thought that court had been deceived or not or fell through natural tendency, but he did say that "we propose showing that the Supreme Court was deceived in the Hyde suit." We do not propose petitioning in that suit, as the law requires we do, to have the court determine whether it was imposed upon. We propose coming into this court; we propose to ignore and set aside the only issues that we have a right to proffer here, and that is the state of the art demonstrating that this was not invention. That charge we do not propose meeting; that charge we do not propose offering. But they say: We do propose showing that now, today, at Chino, someone by some process is producing ore flotation with a greater amount of oil than that specified in the patent in suit, an utterly negligible fact, an utterly irrelevant and immaterial fact.

Now, with respect to the authorities on that point: The Privy Council in the Minerals Separation case at page 1349 says:

"It is a general canon of construction, applicable to all documents, that the document should be construed as if the Court had to construe it as of the date of publication to the exclusion of information subsequently discovered. In patent cases the observance of this canon of construction has great importance. It is common, in such cases, to have a number of documents placed in evidence extending over a considerable period of time, each of which is relied on as disclosing relevant information prior to the date of the patent. If these documents required the assistance of experts to aid the Court in construction, the Court is deprived of the benefit of such assistance
2400 if the witness is asked to read the document not in reference to what was known at the date of publication, but to knowledge only acquired at some subsequent date."

In the case of Tannage Patent Co. v. Donallan, 93 Fed. 811, 821, the Court said:

"With the Schultz process before him, it may be possible for a skilled expert to tan a skin by following what he believes to be a liberal construction of the Francillon specification, but that is not the question. Francillon is not to be interpreted in the light of and with

the knowledge of the Schultz process. The question is, assuming the Schultz process did not exist, does Francillon disclose a tanning process, and by following literally his instructions have you solved the problem of a practical and commercial method of chrome tanning?"

Your honor, in the Hyde case, 207 Fed., 956, 961, said:

"The argument that the prior state of the art was such that to anyone skilled therein the process in suit at the time of its discovery was obvious may, under the circumstances, be well answered by the cases:

" 'Knowledge after the event is always easy. * * * But the law has other tests of invention than subtle conjectures of what might have been seen and yet was not.'

Rubber Co. Case, 220 U. S., 435.
Expanded Metal Case, 214 U. S., 381."

In the Schmerts Wire Glass Co. v. Western Glass Co., 178 Fed., 977, 988, the Court says:

2401 "Before attempting to construe it to see whether it was capable of operation, the legal rule governing the case may profitably be examined, to determine whether the Hyatt specification shows definite means for making wire glass. It may not be difficult, in the present state of the art, to read the Schmertz invention into the Hyatt disclosures; but could it have been done in 1874? No one ever succeeded in doing it, and this is some evidence, at least, that the description was defective. Was the original conception that of Hyatt or of Schmertz? By using twentieth century magnifying glasses, a nineteenth century method has been found efficient, which never was so before, and the immensely important point of view of an advanced art is thus unfairly used to discover an original conception never acted on or made anything of, and which never had any practical beneficial existence."

In Naylor v. Alsop Process Company, 168 Fed., 911, 920, the Court said:

"When it is sought to ascertain the state of the art by means of prior patents, nothing can be used except what is disclosed on the face of those patents. Such patents cannot be reconstructed in the light of the invention in suit, and then used as a part of the prior art. That, however, is precisely what the defendants attempt to do in this case in respect to the Frichot patent. * * * Prior patents are a part of the prior art only by what they disclose upon their face. If they are carried into effect in the industrial world, what is learned from that experience also becomes a part of the prior

2402 art. An expert, however, cannot take a process patent, which has never been applied industrially, and work the process in his laboratory, and discover therefrom something which is not disclosed on the face of the patent, and then transfer that experience back to the time of the patent, and make it a part of the prior art for the purpose of defeating a meritorious invention. That would be ex post facto law of the most pernicious character. Such a practice would be especially misleading in a case like the present."

Now, if your honor please, it seems to me that the issue now lies

plainly before us. There can be no question, and of course we make no question, that it is open to the defendant in this suit to produce anything that lies within his own power, provided his pleadings justify it, with respect to the prior art. We contend, however, that under his opening, under the examination that he has so far made of this witness, it is perfectly apparent that his purpose is not to lay before this court the prior art or anything with respect to the prior art. He has laid no foundation for any such. What he proposes to do is to elicit from this witness, if he is able, and I have no doubt, having regard to his own ability, that he will do it, because he would not have put the witness on the stand otherwise, that by some process now in use at the Chino mill a result which he will claim is similar to the result of the patent in suit is obtained with a greater amount of oil.

And I assert without the slightest fear of being successfully refuted that that is absolutely immaterial in this suit or to any issue that is raised in this suit.

All that Mr. Scott himself says by way of justification or
2403 excuse for his present method of procedure is: "I must be trusted to connect this testimony." But, if your honor please, orderly course of procedure is a matter of justice, except in negligible particulars. It is laid down for a wise purpose, to effectuate justice. To be sure courts have frequently and very properly, where the matter makes no difference, permitted counsel to depart from the orderly procedure; to indulge for their own convenience some other method of proof than that which is the proper method and the proper order; but no court consciously does that in a matter whose inevitable result is absolute injustice to the other side. This method of procedure is, as to us, absolutely unjust and unfair. We are brought here with respect to this defense without the slightest suggestion in the opening as to any issue we are to meet that can be properly tendered by this defendant in this court at this time under the present condition of the law and pleading. We are asked to meet an issue that is immaterial and irrelevant, and that will be ruled out, we respectfully submit, by your honor, the very instant it is frankly and candidly attempted to be brought in.

The Court: Let me understand you. You rather seem inclined to concede now that they can proceed to show the prior state of the art was not what the Supreme Court thought it was. Yesterday you rather argued as though that could not be done.

Mr. Garrison: No, sir, no, sir; excepting as to the ground of estoppel—no; my language is right here. You said: "Has the Supreme Court in a case to which the defendant is a stranger
2404 rendered an opinion; does that opinion establish the validity of the invention and the prior state of the art or the state of the prior art, so that it binds this defendant and other persons who want to litigate this patent?"

My answer was: "Provided nothing is added to the prior state of the art, yes."

That is still my position. My position is in this case—they—I concede that if they want to do that and begin by proper proof, to

prove the entire state of the art from beginning to end, they can do that.

The Court: The court otherwise understood you yesterday.

Mr. Garrison: No, sir; what I was endeavoring to make clear yesterday was this, that until they produce in this court a different state of the art from that before the Supreme Court of the United States, the decision of that court will be followed by this court. Yet in the opening there is no proffer of producing the slightest alteration with respect to the state of the art. The only proffer is to show that now, today, they have discovered—or somebody has discovered that they can take greater amounts of oil than those specified in the patent in suit and obtain the same results. That is the only proffer of proof, and that is the only proof that they propose to show by the witness on the stand, in the question put to him. My statement is that it is proper for them to bring before the court all the proof that is proper under the pleadings with respect to the prior art. If they have done that, and there is nothing before the court that was not before the Supreme Court, the decision of
2405 the Supreme Court finds in this case in the sense in which Judge Putnam stated, and if they do not do that, there is nothing here, and their testimony is immaterial and irrelevant in this suit or to any issue tendered by these pleadings.

Now, returning to the matter I was speaking of a moment ago, I was endeavoring to show your honor the injustice that would result to us by the present order of proof. This gentleman on the stand presumably will swear that at Chino, by a process larger amounts of oil were used than those specified in the patent in suit, and results —let us assume—like those in the patent in suit were produced. Where are we left? Can we intelligently cross-examine that witness? Do we know with respect to what part of the prior art that is supposed to relate? We do not. Is there any way of our finding out? There is not. They have not put before the court the state of the art on which they propose to rely. We might spend hours and days cross-examining that witness, and have Mr. Scott say "that is all waste of time, because we don't rely on that prior state of the art; we rely on something that you were not astute enough to discover in relation to the testimony of this witness." Can anything be a clearer demonstration of the propriety in this case of the orderly course of procedure? When these defendants have opened to your honor, as I think they should be required to do, what the state of the art is that they propose to rely upon, and when they have proven that state of the art, then it will be time enough,—and not until then—for us to be confronted with practical processes or with so-called experiments. At the present time we are left in the
2406 position where, if this course of procedure is permitted, witness after witness will be put on the stand and will develop their theories without a possibility of intelligent cross-examination on our part, and later, undoubtedly, experts will be called, and they will put their finger on this or that or the other, and will give testimony that we cannot then intelligently cross-examine because they will know nothing of practical operation. They will be able by

proving the wrong half of their case first, to deprive us of any intelligent opportunity to meet their case whatever, and I am quite sure that that does not make for the proper administration of justice, and I therefore respectfully submit that our objection is thoroughly well taken at this time, that under the opening of counsel and under the pleadings in this case, under the questions that have been addressed to this witness and answered and under the present question addressed to this witness, it can bring out nothing but irrelevant and immaterial testimony.

Mr. Scott: If the court please, I must say that I am unacquainted with the practice in the jurisdiction from which my learned opponent comes, but it has always been my experience in the trial of a lawsuit that before the experts are called they ought to have the facts before the court to comment upon, and I have proceeded in what I conceived to be the natural and orderly course of procedure. We have not brought expert witnesses here to testify upon nothing; they must have the ground work of fact upon which to pass their opinions, and it was with that idea that I started my presenta-
2407 tion of the case with a fact witness. Furthermore, we have already a considerable mass of testimony in this case in the Hyde record, which is stipulated in here, and which will be supplemented by further fact evidence. The plaintiff here now has more information regarding what our case is going to be than is usual, simply by reason of the existence of this Hyde record which is stipulated into this case, and it is quite impossible, and quite out of order to put expert witnesses on the stand before we have any facts for them to interpret or comment upon or pass their opinions upon.

As to there being no issue tendered in this case, if Mr. Garrison would look at the pleadings, he would find the issues where they are usually to be found. He would find in them the issues set forth which we are going to present. He would find wherein the issues here tendered differ from those in the Hyde case. The testimony which the witness was about to give—and I do not admit that it was necessary it should be so—but it happens to be so by reason of this Hyde record—the testimony which this witness was about to give would have shown that in practical operation the processes of the prior art are practical and are profitable.

As to the statement advanced by Judge Garrison that the decision of one inferior court is binding upon another—one District Court upon another—one Circuit Court upon another—that is too absurd to be entertained a moment. Of course there is a certain comity between the different courts, but it is by reason of the fact that that comity is not always ruling that the Supreme Court has enter-
2408 tained most of the patent cases which it has entertained, by reason of disagreement between the courts of different districts and different circuits.

I am not altogether clear as to the real ultimate analysis of Judge Garrison's position, but if he has any thought that there is any impropriety in this court entertaining a presentation of the full evidence in this case, it certainly will be removed by a simple con-

sideration of two cases that I have brought with me, and from one of which I will read a paragraph. The first case is Mitchell v. Tilghman, 86 U. S. 287; 22 Law Ed. 125. In that case the Supreme Court of the United States held that a patent issued to Tilghman was not, as it purported to be, for a process, but was restricted to the particular apparatus disclosed, and therefore the case was decided against the patentee, and for the defendant below.

Tilghman in a later case sued Proctor & Gamble, that case being commonly known as Tilghman v. Proctor—relating to the same patent. The case is found in the 102 U. S.—I haven't the page—and 26 Law Ed. 279. In this case the same patent was presented to the court; it was the second case involving the same patent. I will read one short paragraph.

"This case involves a consideration of the same patent which was the subject of litigation in the case of Mitchell v. Tilghman, reported in the 19 Wallace 287. The evidence in the present case, which is quite an unwieldly mass, is much the same as in the other, being supplemented however, by the testimony of the patentee
2409 respecting the nature of his original experiments, and the practicability of using practically the coil apparatus described in the patent, together with certain exhibits relating to the novelty of the alleged invention.

"Upon the renewed consideration which has been given to the subject, the court is unanimously of the opinion, contrary to the decision in the Mitchell case, that the patent of Tilghman must be sustained as a patent for a process, and not merely for a particular mode of applying and using the process pointed out in the specifications, and that the defendants have infringed it by the process used by them."

Now, as far as the relation of the first and second trials of these Tilghman cases are concerned, they are on all fours with the case now before the court. In the second case the Supreme Court said "the record is largely the same but supplemented by certain testimony," and the Supreme Court decided in the second case contrary to that which they had decided in the first case. Now, where we find the Supreme Court entertaining such a record and then reversing its previous decision upon such a record, how can there be any question of the propriety of the lower court following the same procedure?

The Court: The argument this morning seems to be that you cannot introduce evidence of what you can do now, without any relation to the prior art?

Mr. Scott: The evidence which I propose to introduce now is a duplication of the prior art, merely showing its practical application on a practical scale. The criticism was made in the Hyde case that all we did was to show laboratory experiments representative
2410 of the prior art, and the Supreme Court was told that they were shams; that was the word.

The Court: This witness whom you have on the stand and by virtue of the question which you have proposed, and others, we will

say, like it, are you proposing to show the prior art, and what can be accomplished by it?

Mr. Scott: Absolutely. I will show by the matters which this witness will describe, as forming part of his practical operations, that each of those different steps is fully described as a step in the prior art, in fact the prior art is already in evidence in the Hyde case, although we will supplement and amplify that.

The Court: Proceed, Mr. Scott.

Mr. Scott: As to the order of proof, your honor, I cannot conceive how I can examine expert witnesses without first putting these facts before the court.

Mr. Williams: I merely wish to say that the facts which this witness will testify to are not facts of the prior art.

The Court: Now, he says they are, and we will have to assume that they are.

Mr. Kremer: Your honor will have to determine that.

Mr. Williams: He says that the witness will describe experiments performed at a time within the last few months. Now, how can they be facts of the prior art?

The Court: It might be. He will say that the prior art was thus and so then, and it could have been done then, and as cor-
2411 roboration of that, I will show you that it can be done today.

Mr. Williams: How are we to know what facts of the prior art these late facts can be linked up with?

The Court: Well, of course, a party may introduce evidence on many occasions where it is absolutely impossible for the other side to meet it, perhaps, but that would not go to its materiality at all; it would be simply your misfortune.

Mr. Williams: Would not that be a misfortune imposed upon the plaintiff by reason of the order of proof not being the regular and proper order of proof? Now, one further objection, your honor, if your honor wishes to hear that before ruling.

The Court: Surely. I am going to hear you with the utmost liberality, both sides.

Mr. Williams: The objection to the description by the witness on the stand here of experiments conducted by him at a plant in Chino, New Mexico, when no representative of the plaintiff was present, and which might or might not have been honestly conducted, with no opportunity on the part of the plaintiff to test the operation or its results—our objection is that such testimony of experiments is secondary evidence, and incompetent for that reason; ex parte experiments, done and completed without our knowledge and without opportunity for us to criticise and without opportunity for us to examine the operations. Now, it is peculiarly true that this defendant has a plant in Butte, Montana, within a short distance of the court house, and that we are here; and if he wants to prove any-
2412 thing by way of experiments, which he says may illustrate the art as it existed twelve or more years ago, why he can produce those experiments in our presence and in the presence of the court, and then we may have some reasonable judgment as to what was done and how it was done. I therefore raise the objection

that this testimony of this witness as to experiments performed at Chino is secondary evidence and incompetent.

The Court: With reference to the last objection, of course the court will take the circumstances into consideration in weighing the credibility of the witness and how much importance should be attached to experiments of that kind, out of the presence of the plaintiff, and of course to which it has had no access.

The objection made yesterday, the second, is:

"The Supreme Court of the United States having decided that our patent is a valid patent or a patentable invention, any attempt to alter or attack the facts found by the Supreme Court is against the doctrine of stare decisis, and is incompetent and immaterial."

I understood from some of the arguments yesterday that the Supreme Court having found the prior art to be so and so, that that could not be questioned in this case; but I take it from what counsel urged this morning in his argument, and in response to a question of the court, that they do not now and did not then assume that position.

The objection on the score of estoppel—former adjudica-
2413 tion, in that this defendant was so related to the former suit that it cannot now question the validity of the patent—of course the court still has that in reserve. It is not satisfied from the evidence now to say that this defendant is bound by that decision. At this time, however, on that score, the objection is overruled.

The other portion of the objection going to the testimony of the witness in reference to experiments and practice at the present time—of course if it relates to something happening since this patent, and merely to what might be done now, it will be assumed that it is in the light of what this patent has given, and could have no bearing and no materiality in the case. I think that is made plain by all the cases.

In the matter of counsel's opening statement, it is somewhat of a practice not to criticise it if counsel in the opening statement indulged somewhat in oratory. I do not believe that they can be held—neither they nor the plaintiff—to have fully set out their case in the opening statement, or what they expect to prove. There are cases, or have been, where counsel is held strictly to his opening statement, and upon his opening statement he may be nonsuited if he was the plaintiff, and if he was the defendant it may be ruled that he had no defense. But that has never been the practice here, and I do not believe that it is very favorably considered anywhere any more. Now, the defendant, in proffering this witness says that he does propose by this witness to show the state of the prior art, and what might be done with and under it, and if he proposes
2414 that, of course he has a right to show what it was then, and to corroborate it by what could be done with it now. He says that is his aim and purpose. I think if that is true, it meets the main objection of counsel for the plaintiff. Certainly it is permissible to prove as a circumstance that a thing can be done now—to prove as a circumstance that it could have been done before. If that is all that counsel is aiming at, the court thinks it is admissible.

As to the order of proof, I cannot see that he is proceeding at all out of the proper order, if that is his purpose, to show the former state of the art, and to apply it to what he claims is being done now. In a case like this, a case of such large importance and where the issues are to be so strenuously contested, it is inevitable that the testimony and the evidence will cover a very wide field, and also it is inevitable that some will creep in—considerable will creep in that might not be strictly relevant or material and not strictly in proper order. But the court thinks that when it comes to render its decision, that all this testimony, insofar as it is material will find its proper place, and what is immaterial will probably be excluded, and the court has heard what counsel has said about these experiments. That same question arose in the Hyde suit, and has been commented upon by the Supreme Court of the United States, experiments by one party out of the presence of the other, and to which the other had no access—they may not be entitled to very much weight, but that again is a matter for determination in weighing the testimony and determining the credibility, and not to exclude it as immaterial.

2415 The objections will be overruled.

Mr. Williams: The plaintiff requests an exception.

The Court: Let the exceptions be noted.

Mr. Garrison: Just another word. If it shall appear at the conclusion of the direct examination of this witness that for any reason, or for no reason, his testimony is not so referred to the prior state of the art as to direct our attention thereto, we will ask the right to postpone our cross-examination of this witness until the connecting testimony is given.

The Court: You have always that right, and you have always a right to make motions to strike any testimony that on examination appears to have no place in the record. Recall your witness.

Mr. Kremer: That is purely a matter for the discretion of the court.

Mr. Garrison: He has ruled.

Mr. Scott:

Q. 10. Mr. Wicks, I will repeat in substance the question now upon the record: Have you in the operations of the Hurley plant of the Chino Copper Company, used various quantities of oil or oily reagent?

A. We have.

Q. 11. Have your operations involved any comparison of the effects obtained by a more and greater amount of oil?

A Well, we have prepared certain comparisons, as much for our own information as anything else, to show the relative effects

2416 of the various quantities of oil.

Q. 12. You have before you, have you, a statement of such a comparison?

A. I have.

Q 13. Covering what period of time?

A. I have a statement here covering the operations of one plant from December 8, 1914, up to December 20, 1916, compared with the same plant from December 21st, 1916, to March 31st, 1917, that division being made because of the marked difference in the operations before and after that date.

Q. 14. That is, a division was made at the end——

A. (Interrupting.) —at the end of December 20th.

Q. 15. Between December 20th and 21st?

A. Yes, sir.

Q. 16. Now, before December 20th, how were the operations conducted as to the amount of oil used per ton of ore?

A. Well, the operations were conducted in relatively smaller amounts of oil during the major part of the time. There wasn't any great regularity about it, but the quantities of oil varied from a minimum of 1.48 pounds per ton during the third quarter of 1915, up to a maximum of 23.7 pounds per ton which occurred in November—in the middle part of November, 1916.

Q. 17. What days of November was that?

A. November 18, 19 and 20, three consecutive days.

Q. 18. On these three consecutive days the amount of oil was 23.7 pounds per ton?

2417 A. Yes, sir.

Q. 19. Is that figure an average for three days?

A. That is an average for three days.

Q. 20. What was the purpose in using that quantity of oil at that time?

A. Well, necessity, in order to produce results.

Q. 21. Well, just amplify that a little "in order to produce results."

A. That is this quantity of oil was used by the operators in the plant to produce a satisfactory recovery and a satisfactory grade of concentrates.

Q. 22. And at that particular time what would have happened or what did happen with a smaller amount of the particular kind of oil then being used?

A. On this particular day?

Q. 23. Well, what would have happened to the results with a lesser amount of oil than as specified upon these particular days?

Mr. Garrison: I object. I do not see how this witness can speculate if something had taken place other than what did take place.

Mr. Scott: I will withdraw the question.

Q. 24. Was the kind of oil used upon November 18th, 19th and 20th, 1916, ever used in a lesser amount than 23.7 pounds per ton?

A. May I ask you to repeat that question?

(Question read.)

A. Yes, that same kind of oil was used in lesser amounts.

2418 Q. 25. And with what result as to the efficiency of the operation?

A. Well, with somewhat poorer results. Thinking of the third

quarter of 1916, during which we used 8.7 pounds per ton, and the recovery obtained during that third quarter was 96.7 as compared with a recovery during these three days which I have mentioned of 98.4.

Q. 26. And how did the amount of copper in the tailings compare?

A. During the third quarter of 1916 the average tailing for the three months was .306. During these three days the tailings averaged was .244% copper or .062% copper lower by the use of a larger quantity of oil. I would also point out that that was accomplished on a somewhat higher grade ore which of course would ordinarily tend to a higher tailing loss.

Q. 27. Can you state what—or at least in a general way—what oils were used during the period from December 8th, 1914 to December 20th, 1916?

A. We used a tremendous variety of oils. I have a complete list of them but it will take some time to go through that.

Q. 28. It will not be necessary to have a complete list, but if you can indicate in a general way what they were.

A. Just a minute I can.

Mr. Scott: I may say to the court that the purpose of offering this statement in evidence is for the convenience of the court and
2419 opposing counsel, I am perfectly willing to furnish copies at this time in order to enable the testimony of the witness to be better followed.

Mr. Garrison: I don't understand he offers it to have any probative force, but merely as illustrative of the witness' testimony. Am I correct in that?

Mr. Scott: The witness will verify it and another witness will verify the report.

The Court: He will supply you copies if you desire. I do not believe the court will care for any now.

A. Going back to my earliest record we used pine oil—it don't say what kind, and a certain creosote, California crude oil, and various combinations of these different oils or various mixtures of these different oils. That was during January of 1915. Then, taking up the next month we used this same combination with the addition of a Texas crude oil.

Q. 29. Were these oils used separately or in a mixture?

A. Both. Sometimes we added each oil separately in order to regulate the proportions of the oils according to the characteristics of the oil and at other time we made up mixtures. For instance, in March of 1915, among the different oils we used, we used an 80% California crude oil and a 20% pine oil. That was used in combination with some creosote, but I am not able to say from this sheet what proportion of the mixture and the creosote we used.

2420 Q. 30. That is, you used the pine oil and crude in a mixture with some creosote?

A. We used the pine oil and crude as a mixture, that is, being made up in a mixture and fed from one tank, while in another tank we supplied the creosote.

Q. 31. But all three came together?

A. All three came together in the pulp. It is rather difficult to pick these oils out. Calling attention to the new names, we used Oklahoma crude oil in a number of different proportions; Texas No. 4 oil made up in a mixture of 70% Texas No. 4 oil and 20% creosote oil and 10% pine. Is it necessary for me to mention each month as we go down?

Q. 32. I think not. If those that you have stated are representative.

A. Do you wish me to take up any of the more recent practices?

Q. 33. Well, we will come to that later. Now, these operations extending from December 8th, 1914 to December 20th, 1916, were these actual mill operations for profit, or experiments?

A. Oh, those were regular operations.

Q. 34. You might name the tonnage treated during that period, extending down to December 20th, 1916.

A. From December 8th, 1914, to December 20th, 1916, a little over two years we treated 201,139 tons or an average of 272 tons per day. I think the average per day will not quite agree with the total tonnage because of the plant being down at times, for a short time. I am not certain as to that, however.

2421 Q. 35. Now, subsequent to December 20th, 1916, what change was made in the operation of the Hurley plant?

A. Well, we began using, on December 21st, we began using continually a quantity of oil greater than 20 lbs. per ton.

Q. 36. Will you state, for the different intervals after December 21st, how much oil per ton was used?

A. From December 21st to 31st we used an average of 24.57 pounds per ton. That was for 11 days. Then, for the month of January we used an average of 21.10 pounds per ton. In February we used 21.70 pounds per ton, and in March we found it necessary to use 23.73 pounds per ton.

Q. 37. And the average for the entire first quarter of 1917?

A. The average for the entire first quarter of 1917 was 22.18 pounds per ton, and the average for all operations from December 21st, 1916 up to the date of this report, which is March 31st, 1917—at least, that was the date when the figures were closed, was 23.38.

Q. 38. Was that 23.38?

A. Pounds per ton.

Q. 39. Were these operations with over one per cent of oil subsequent to December 21st experiments or actual operations in a mill for profit?

A. They were actual operations performed by the regular operators.

2422 Q. 40. And will you state what tonnage was treated from December 21st to March 31st, using over 20 pounds of oil per ton?

A. We treated during that period 22,536 tons.

Q 41. When the change was made from a lesser to the greater quantity of oil, from December 21st, 1916, was the kind of oil

changed, or were changes made in the apparatus, or method of operating the apparatus?

A. There was no change in the apparatus or in the method of operating the apparatus at all. The only change was that we began using a larger quantity of a somewhat cheaper oil and a lesser quantity of the more expensive oil. In these records——

Q. 42. (Interrupting.) You are going to state, are you, the oil mixture which you used after the increase in amount; that is after December 21st, 1916?

A. I think I can give it. Before the change was made we were using a combination of Barrett's No. 4 oil, which is a coal tar creosote or generally understood to be a coal tar creosote, and an oil known as the Jones flotation oil, which I think is a Kansas fuel oil. Now, we were using that in approximately the proportion of 90% Barrett oil and 10% Jones oil.

Q. 43. That is, with the smaller or the larger amount?

A. With the smaller amount.

Q. 44. Before December 21st?

A. Using approximately 90% of the Barrett oil, and about
2423 10%, I think, of the Jones oil. When we began using the larger quantity, the proportions were almost exactly reversed; that is, we began using only 10% of the Barrett's oil, and about 90% of the Jones. Of course in our operations the character of ore fluctuates a little and these proportions are not absolute from day to day. The operators are allowed some discretion as to the proportions.

Q. 45. Was there any other oil used besides the Barrett and Jones?

A. We used a little pine tar; I don't know the proportion or the quantity, but we have always used that to a very limited extent. That applies both before—That is both during the first 20 days of December and during the last eleven days also. There were eight days during the first twenty days of December, during which they had to use a little pine tar.

Q. 46. That was with the small amount of oil?

A. That was with the small amount of oil, and there—two days during the last eleven when they found it necessary to use the pine tar.

Q. 47. Did you operate at any time without the pine oil?

A. Yes, sir.

Q. 48. Simply with the Barrett and the Jones?

A. Yes, sir; both before and after.

Q. 49. Is the use of the pine oil exceptional or general?

A. It is rather exceptional. It is necessary sometimes; we do not know why.

2424 Q. 50. How did the recovery of metal and the grade of concentrates compare after December 20 and before? That is, with the large and small amount of oil?

A. Well, taking all operations up to and including December 20th, 1916, a little over two years, our average tailings loss in that plant was .48% copper, and the average recovery was 95.528. The average tailings loss for all the period subsequent to December 20th, that is, beginning with December 21st, 1916, was .32% Cu. or .16%

Cu. lower than the operating average up to that time; and the recovery for that last period in question was 96.356%, or approximately 1.4% higher than the average operation up to that time.

Q. 51. In view of the figures as to the recovery and tailings which you have just stated, are the operations with larger amounts of oil subsequent to December 20th more or less profitable than the operations prior to December 21st with smaller amounts of oil?

A. I haven't the figures here but I have figured it a number of times and I am quite confident that the operations with the larger quantities of oil are considerably more economical, that is, are considerably more profitable, taking costs and the results both into consideration.

Q. 52. In giving your testimony, you have referred, I believe to a written report. Is that correct?

A. Yes, sir.

Q. 53. And this report, a copy of which you have in your
2425 hands, will you state under whose supervision these operations were carried on?

A. These were carried out under my direct supervision.

Q. 54. And this—And state whether this report was your report, in your official capacity?

A. Yes, sir, it is.

Q. 55. And you know this report to be correct, do you?

A. Yes, sir. I have one of the original reports here and I compared it personally with that so as to be sure that it is all right.

Mr. Scott: I offer in evidence the report which the witness has referred to in giving his testimony.

Mr. Garrison: May I ask one question before it is admitted?

The Court: Yes.

Examination on voir dire.

By Mr. Garrison:

Q. 56. I understood you to say in answer to a question on direct examination that all of the operations shown upon this paper, which dates from December 8, 1914, to March 31st, 1917, that all of the operations between those dates were carried on by you or under your direction. Is that correct?

A. Yes, sir.

Q. 57. So that you are able to tell us, of your own knowledge, with respect to every operation between those periods?

2426 A. Well, I was absent from the plant for about six days I think, but I had access to the original reports; and, in discussion with the operators, I have every reason to believe that they are absolutely right because they in no way differ from those results which were obtained during my pre ence here.

Q. 58. All I want to know is whether you now accept the responsibility with respect to the operation between all these dates, so that when we come to ask you about them you will not say, "I don't know about that operation; I am not the one that you should ask about

that operation." You have said all of these were carried on by or under your direction, but if that is not true that is one thing; if it is true that is another.

A. Under my direct supervision.

Q. 59. Does that mean that you are able now, in response to questions, to tell us with respect to each of the operations shown upon this, from the 8th of December, 1914, to the 31st of March, 1917?

A. Perhaps I don't understand you. You want the period first in—I thought you were discussing this period of December 2nd to March 31st.

Q. 60. Now you were asked whether all of these operations about which you had been testifying were carried on by you or under your direction?

A. Well, I may have to correct that. The operations from the first of May, 1915, were carried on under my direct supervision, because I did not go to the Hurley plant until May of 1915.

2427 Q. 61. Now, from May, 1915, to March 31st, 1917, is it the fact that you have personal knowledge with respect to the matter discussed upon this paper so that, upon cross examination, you are the one who should be asked and can respond to the particular operations? Is that correct?

A. Within the limits I have now made, yes, I think so.

Q. 62. But your knowledge should be complete because you were the person who had complete knowledge; isn't that correct? I am not talking about your memory now; I am talking about your knowledge.

A. I believe I have about as complete knowledge as anyone.

Q. 63. That does not quite answer my question. We do not want to be left in this position: "Yes," you say, "I know all about this" and we admit that paper with that understanding and then when we ask you, have you say "Oh, no, I don't know anything about that; that is outside of my domain." That is what I am trying to elicit from you. Was that all under your knowledge and are you the proper person to be asked concerning the verity of everything shown on that sheet?

A. All of these operations were conducted under my direct supervision and I had at least as much knowledge as to the results and the methods and so on as anybody ordinarily has when they supervise a plant of that size.

2428 Q. 64. Well, sir, you don't quite answer my question. What I want to know is this:—You can see I am not trying to trap you or anything—I simply want to know whether you are the person from the Chino Company and of whom we should inquire if things which are shown here correctly represent what took place or did not take place.

A. Do you want me to say I am the only person——

Q. 65. I don't want you to say anything but the truth, sir.

A. As I understand your question, I have answered it that I had, I believe, as complete knowledge of these operations and can answer questions just as intelligently as to the operations, as anyone.

Q. 66. Well, have you broad enough knowledge to say whether the facts and other things that are on this sheet correctly represent the facts as they took place at the time that they are purported to have taken place?

A. I think I have.

Mr. Scott: I will ask, if the court please——

Mr. Kremer: We want to eliminate three or four lines.

Mr. Scott: Before the offer is passed upon, to eliminate from this report the first three lines, that is the part from December 8th to 31st, 1914, the first quarter of 1915, and the second quarter of 1915, in view of the witness' statement that his supervision began in May, 1915. And, with that amendment of the report, I will renew the offer.

2429 The Court: It will be admitted.

Whereupon the report was admitted in evidence and marked defendant's exhibit 26.

Mr. Garrison: Now, I move to strike out of this witness' testimony all operations prior to May, 1915, when he says his knowledge of the situation began.

Mr. Kremer: We consent that that be done. We have eliminated them from this report, everything prior to the time Mr. Wicks took charge.

The Court: The motion will be granted.

Direct examination (continued).

By Mr. Scott:

Q. 67. Referring to this same period of time, what was the nature of the material being treated by flotation?

A. This material was—what is ordinarily known in our plant as the slime vanner concentrates.

Q. 68. And just what is that, in simple terms?

A. In our plant the material is treated on vanners and given a rough concentrating on the vanners or on all the vanners of the plant, and then the finer portions of that vanner concentrate is retreated in this flotation plant under discussion.

Q. 69. The finer portions?

A. The finer portions, yes, sir.

Q. 70. Classified somehow?

2430 A. Yes, it is classified in hydraulic classifiers and the coarser portion is treated on tables while the finer portion comes to the flotation plant.

Q. 71. Can you state approximately the degree of fineness of this material treated by flotation, as set forth in this exhibit 26?

A. I have no screen analyses to show, because the material is so fine that a screen analysis does not show up anything; but those that we have taken show approximately 90% of the material passed 200-mesh, but of course it is still coarse enough to be granular, or partly so.

Q. 72. Do you treat material of any different nature by flotation at the Hurley plant of the Chino Company?

A. We also treat the vanner tailings by flotation, that is, the slime portion of them.

Q. 73. Now, if you can, will you state the quantity of oil that you have used in the different parts in treating these vanner tailings?

A. Well, up to date, our records show that the average quantity of initial oil used was 1.13 pounds of oil per ton of material treated.

The Court:

Q. 74. How much was that?

A. 1.13 per ton; that is, one and thirteen-one hundredths pounds per ton.

Mr. Scott:

Q. 75. I would like to ask the witness if he has some extra copies of this. I think I will verify it in the same way as the other
2431 report, and I think it will be more convenient for the court and counsel to have this before them even before it is formally offered.

A. I have three copies.

The Court: What is this?

Mr. Scott: This is a different one, on different material.

Q. 76. You stated, I believe, that up to date you have used 1.13 pounds of oil per ton?

A. Yes, sir.

Q. 77. That is an average covering what period of time?

A. That is an average covering all operations since the 16th of April, 1915, up to the last of March of 1917.

Q. 78. Have you any figures showing the period in which large amounts of oil were used separate from the period where small amounts were used?

A. We segregated certain days, for illustration, during which we used various quantities of oil.

Q. 79. That is the tabulation that appears at the lower part of this sheet?

A. Yes, sir.

Q. 80. I notice that you have used as high as 37 pounds of oil per ton?

A. Yes, sir.

Q. 81. What kind of oil was that?

A. That was a combination of a coal tar with what is known as a stove oil.

2432 Q. 82. Just those two alone and nothing else?

A. Well, we used a minute quantity of Barrett's No. 4 Creosote oil in conjunction with that, but it happens that this does not show that.

Q. 83. Have you any information as to the part these various ingredients of the oil mixture play in the process?

A. You mean—I don't think I understand your question, Mr. Scott.

Q. 84. Your statement is that you have used a mixture made up of several different oils?

A. Yes, sir.

Q. 85. And the question was as to what part each of these ingredients played.

Mr. Garrison: That is not the question. The question was whether he had the information. If he says he had, we are entitled, before he gives it, to ascertain the source of it.

Mr. Scott:

Q. 85½. Well, state if you have any information on the subject.

A. Yes, sir; I think our experience has given us information on that.

Q. 86. And state, so far as you know, what the effect or function of the different ingredients is.

A. The function of the coal tar is to—well, that acts as the major oil or the collecting oil, if you like. The stove oil, while it probably had some effect in accomplishing flotation, it was also beneficial in diluting this coal tar to the point where it could be fed into
2433 the plant regularly and measured accurately and so on, on account of the consistency of the coal tar, it is rather difficult to handle it alone, even at high temperature. The Barrett oil, I think probably, acted in the formation of the froth to a certain extent, or what is known ordinarily as frothing oils.

Q. 87. Have you any information as to how either one of these ingredients would have acted without the other and in quantity equivalent to that which it was used in the mixture?

A. Yes, I think we have. If you will permit me I might state one instance in connection with our runs.

Q. 88. You may do so.

A. During one of these tests; I can't identify just which one, but I think it was the one of March 27th——

Q. 89. 1917?

A. 1917, which is the fourth one from the bottom on the tabulation, during which we used 32.27 pounds of oil per ton, we used there a combination, or rather we used an oil which we called the Taft oil—it happens to be shipped from Taft, California,—and we used with that a very small quantity of Barrett's No. 4 oil. During that test which represented—or during that run which represented the length of time that the oil lasted, the length of time that the supply lasted, we watched the operation very carefully and I
2434 was present on the plant a good many hours and I remember that we had been operating steadily for four or five hours and I was up on the flotation machine and the results that the machines were producing were very satisfactory. They were just about as good as we thought we could make them and there wasn't any particular alteration or adjustment being made, and within a minute or two minutes' time the froth apparently disappeared right off the

surface of the machine and the separation of the finer particles ceased, practically—there were some, but practically none. And so I sent one of the operators down immediately to find out if there was anything wrong in the apparatus below, and he came back and told me that the only thing that was wrong was that the pump which had been pumping the large quantity of that Taft oil, had had to be shut down to have the steam end of the pump packed.

Q. 90. What oil was that pump pumping?

A. That was pumping this heavy Taft oil which we were using in large quantities. Well, of course, I went down right away and watched them until they started to pump again, and in the meantime to satisfy my curiosity, I made sure, personally, that the Barrett No. 4 creosote oil, which was being used in minute quantities, was still being used, and which was being fed independent of the other, in the ordinary manner, was still going into the plant. And so, as soon as the pump was started again I made sure that the correct quantity of oil was going in, that is the quantity that we
2435 had had on before, because we had good conditions before, was going in, and I went back in the plant and the conditions came back, the same general appearance, that we had before, with absolutely no other change.

Q. 91. Do you remember about what proportions the Taft oil and—what was the other?

A. The Barrett No. 4 creosote.

Q. 92. Barrett No. 4 creosote, were present on that occasion?

A. I don't think we used as much as one-tenth of a pound.

Q. 93. One-tenth of a pound?

A. Yes, sir, per ton of ore.

Q. 94. That has been the customary amount for you to use?

A. No, that is much smaller than the customary amount.

Q. 95. But upon this particular occasion, I mean?

A. On this particular occasion we found it necessary to cut down the Barrett No. 4 creosote oil to that amount to get the correct frothing condition in the plant.

Q. 96. When you talk of a correct frothing condition, precisely what do you mean?

A. Well, what appears to be correct to one operator of course would not appear to be correct to another, but the condition where the consensus of opinion of all present is that we are getting about the best results, just by visual tests.

2436 Q. 97. What can you say as the absence of a froth with different amounts of oils?

A. It depends on the oils you use, but as a general rule the froth is more abundant with the larger quantities of oil than it is with the smaller quantities.

Q. 98. Does the increase in the quantity of froth ever become objectionable?

A. It does at times.

Q. 99. And what steps are taken at such times?

A. In such a case you either change the oil combination or cut down the quantity of oil.

Q. 100. In treating this slime vanner tailings, was it necessary to make a change in the apparatus or any change in its mode of operation when increasing the amount of oil on January 7th and subsequent days?

A. Well, so far as the actual mechanical equipment was concerned, we made no mechanical changes; that is, so far as the use of apparatus or anything of that kind is concerned, we made no change, but we discovered that we got better results when we used the larger quantities of oil, if we decreased the amount of primary agitation.

Q. 101. To decrease it?

A. Yes.

Q. 102. By preliminary agitation, you mean just what?

A. What we ordinarily term the emulsification in the emulsification plant; that means passing the pulp through machines which serve as mixers only, and from which no separation is made.

2437 We find the best results are obtained if we shut those down and did not add the oil until the material was about ready to go into the plant. We have also found out that in some of the machines a lower air pressure was better, that is a lesser quantity of compressed air was required to produce the desired results when we were using the larger quantities of oil.

Q. 103. That was in an apparatus of what type?

A. The Janney mechanical air type.

Q. 104. I am referring both to the operations upon the Vanner concentrates and the slime Vanner tailings. I would like to have you describe the apparatus, without going into great detail.

A. It will probably be necessary to take each plant separately, because they are differently arranged. In the treatment of the Vanner concentrates we employ what is ordinarily known as the single Spitzkasten, Janney mechanical machine.

Q. 105. What mechanical machine does—by mechanical machine what are you attempting to distinguish it from?

A. I am attempting to distinguish from what is ordinarily called the air machine, or the mechanical air machine as the case may be.

Q. 106. In this Janney mechanical machine, state briefly what the machine is?

A. It consists of an agitating cell provided with baffles around the cell, in which revolves a pair of impellers, mounted on a shaft,

2438 which in turn is operated by a vertical motor which sets over the top of the cell, and then alongside of this agitating cell or chamber is the box or Spitzkasten in which the separation is made.

Q. 107. I think I will interrupt you, I would like to ask you to make a sketch as you go along so that the court may get a clearer idea of what that apparatus is?

A. (Witness drawing sketch.)

Q. 108. Now, I think you had better describe that and put letters on it as you go along, and that will give a somewhat better illustration?

A. You want me to hold this in my hand?

Q. 109. I think you can do it that way better, and put letters on there as you go along, and state how the pulp moves?

A. Now, following the manner in which the pulp enters the machine, I might indicate it this way: The feed to the machine enters here at A. The feed passes on into the agitating chamber, which is B, and then these agitators here throw the pulp out against these little baffles which I might mark as C on both sides here, and the agitators I mark as D. In the agitating operation, that causes the material to become mixed with the oil and air and so on, and in the operation it is thrown out into a chamber up here which simply acts as a gathering apparatus. From there it flows into the Spitzkasten in here, which I mark F. Now, in this particular machine
2439 there are some circulating pipes which come up through this way, and a portion of the material then goes up through these circulating pipes and back into the agitating cell again, and may go around a number of different times before it finally goes out. I will letter the pipes G. There are a pair of them in some of the machines.

Q. 110. Where is the froth taken off?

A. The froth is taken off at what is called the overflow lip, which I will mark H.

Q. 111. Does it simply flow off of itself, or is it scraped off?

A. Sometimes one way and sometimes the other.

Q. 112. What causes the pulp to pass upward through the pipe G and back into the agitating cell?

A. Well, the water level is ordinarily kept up fairly close to the overflow lip.

Q. 113. What keeps it up there?

A. The control of the water level is accomplished by a tailings pipe, a standpipe which regulates the height of the water, because when the water gets up above a certain height the excess overflows, and this overflow pipe I will letter as I. That pipe is adjustable so as to regulate the conditions of the machine. Now, the water level being up here, it forces some of the material to pass back through there.

Q. 114. The pulp is removed, is it, from the agitating cell by this agitator?

2440 A. Yes, as the pulp flows in there the agitating plates strike it, and in their operation they take it up and throw it out of the cell.

Q. 115. Then the agitator keeps the agitating cell comparatively empty?

A. Yes. If you look down in there, as you can sometimes through some of the machines through the vent pipe, there you can see it is almost a mist in there; it is thrashed up pretty finely.

Q. 116. It is for that reason that the height of the water in the spitzkasten is sufficient to force the pulp back into the agitating cell?

A. I think so, yes, sir.

Q. 117. What have you represented there at the top?

A. That is the motor, an electric motor.

Q. 118. Now, what kind of cell is that that you have drawn which you call the mechanical cell or mechanical air?

A. It is a mechanical cell of the single spitzkasten type.

Q. 119. A double spitzkasten would be how?

A. It would be simply a representation of this spitzkasten that I have described, and another on the opposite side of the machine.

Q. 120. And it would take the froth from both sides of the machine, instead of from one?

A. Yes.

Q. 121. Can you describe in a general way how the me-
2441 chanical air machine differs from the mechanical machine you have drawn?

A. The mechanical air machine simply has the addition of an air chamber in the spitzkasten which is furnished with low pressure compressed air; the air is added to this air chamber—the top of the air chamber is covered with cotton twill, of a number of thicknesses according to the conditions, and that breaks the air up into very minute particles, and it assists the machine in accomplishing the flotation results.

Q. 122. Simply a box with one side of it cloth, and air supplied to one side so that the air may go out and assist the flotation?

A. Yes.

Q. 123. And that is in to the Spitzkasten?

A. Yes.

Q. 124. And that is what you call a mechanical air machine?

A. Yes.

Q. 125. And without that air box it is a mechanical machine?

A. Yes.

Mr. Scott: I offer that sketch in evidence, simply as an illustration of the witness' testimony.

Sketch admitted in evidence and marked Defendant's Exhibit 27.

Q. 126. Can you obtain illustrations of these mechanical
2442 cells that will be a little clearer than your sketch?

A. I think so; at least we can produce blueprints of them.

Q. 127. That might suffice. How does the material that you have referred to as the slime vanner tailings compare in fineness with the vanner concentrate?

A. Well, the slime vanner tailings are considerably finer.

Q. 128. About how much finer; I think you stated that ninety per cent. of the vanner concentrates would go through a 200 mesh, didn't you?

A. Yes. It is rather difficult to say just how much finer, but anyway we know that in vanner concentration, the coarser material or the coarser particles have a tendency to go over with the concentrate, and the finer particles have a tendency to go with the vanner tailings.

Q. 129. And these vanner tailings you would term extremely fine material?

A. Yes.

Q. 130. Fine slimes?

A. Yes.

Q. 131. Now, I notice that the lower part of this tabulation, which relates to slime vanner tailings, I find that your reports of the treatments on various dates will vary, and the amounts of the oil will vary. Will you state how the treatment with these various amounts compares as to efficiency?

2443 A. As a rule the larger amounts of oil are very satisfactory.

Q. 132. Is that true as to commercial results?

A. Yes, sir.

Q. 133. Now will you state for the record a comparison of the results with large and small amounts of oil, which illustrates your statement?

A. Well, of course it is difficult to average up these tests from these solitary days, because they represent so many different conditions; but I might compare these individual days with the average of our results up to date, if that is satisfactory.

Q. 134. That will be satisfactory.

A. Now, taking March 14th for example, so as not to string it out too long—March 14th we used 22.80 pounds of oil per ton, and on that date the average tailings loss was .48 per cent. copper, and that result was obtained from an average ore or material containing .80 per cent. copper.

Q. 135. How much tonnage was treated?

A. We treated 122 tons. The reason for the small tonnage was that we only had a small quantity of oil. That compares directly with the average results of our operations up to date, in which we were treating material averaging .804 per cent. copper, and the average tailings loss of our operation up to date was .543 per cent. copper as compared with .48 copper for this particular run that I was describing. The per cent. of the recovery of our operations up

2444 to date for this particular material was 33.139 against this date of March 14th of 41.00; so that for that particular combination of oils, the results were considerably better than the average of our operations up to date.

Q. 136. I notice upon this table with reference to the slime vanner tailings that the indicated recovery varies from—I see 24 per cent. here—up to I think the highest is about 37 per cent.?

A. 40.49 I think.

Q. 137. 41 there in one instance?

A. Yes.

Q. 138. Will you explain why the recovery is of that order of figures?

A. Well, because of the character of the material treated.

Q. 139. Explain that, please?

A. All of our ores contain—practically all of our ores contain considerable quantities of the oxides of copper and carbonate copper, and in this particular flotation operation it has not been profitable to recover them.

Q. 140. Does the ordinary flotation operation recover these oxides and carbonates, or what mineral does it recover?

A. The ordinary operations recover only the sulphides?

Q. 141. And has that been the case with the operations tabulated upon this sheet of slime vanner tailings?

2445 A. Yes. While we probably made some recovery of the oxidized material, it probably was very small.

Q. 142. I notice that this report upon the treatment of slime vanner tailings is signed O. Wiser. Who is Mr. Wiser?

A. Mr. Wiser is the metallurgical engineer of the plant.

Q. 143. And how does it happen that Mr. Wiser's signature appears upon this slime vanner tailings sheet, while the treatment of the vanner concentrates sheet was signed by you?

A. It happened that this report was closed up one afternoon when I was down in the plant, and we were anxious to get it out, so Mr. Wiser signed it. It has no particular significance.

Q. 144. You have the same knowledge as to the accuracy of this report of the slime vanner tailings as upon the other reports you testified about?

A. Yes. I noticed that there are a few days there prior to May 1st, 1915, that, of course, I have not direct knowledge of, but subsequent to that——

Q. 145. Do you know who was in charge at that time?

A. Mr. Wiser was directly in charge of the operations at that time.

Q. 146. During those two days?

A. During that period in April there from the 16th to the 30th.

Mr. Scott: I offer this tabulation in evidence, and will
2446 state that I will have the first entry verified by Mr. Wiser later.

Sheet of tabulations, reports on slime vanner tailings, admitted in evidence and marked Defendant's Exhibit No. 28.

Whereupon an adjournment was taken until 2:00 P. M. of this day, Wednesday, April 18, 1917.

Wednesday, April 18, 1917, 2:00 P. M.

Trial resumed pursuant to adjournment, all parties present; whereupon the following proceedings were had:

Mr. Scott:

Q. 147. Mr. Wicks, you stated this morning something in regard to the over-abundant frothing with large amounts of some kinds of oil; with such oils, as I remember, you reduced the emulsification, the preliminary agitation, and reduced the supply of air in those cells that air was supplied to. What was the reason for diminishing the emulsification and the air supply?

A. Well, simply to cut down the over-abundance of froth.

Q. 148. And what is the effect of that over-abundance of froth; in what way is it objectionable?

A. The greater the volume of froth, generally, the greater amount of gangue becomes entrapped in that froth and is carried over.

2447 Q. 149. Simply on account of the great depth of froth?

A. Of the great depth of froth, yes.

Q. 150. In your plant is there any of the material that first goes off from the spitz boxes returned to the head of the machine?

A. Yes, a portion of it is.

Q. 151. Now, in a general way won't you explain the relation of these machines one to another; for instance you made a sketch of a single one this morning. Tell us how they are arranged in the plant?

A. Well, the machines are ordinarily divided in the plant, or named under three different names or classes. The first machines, or the machines to which the feed passes first, are called emulsifiers, and they serve the purpose of simply agitating the ore pulp with the oil and air and so on, and no separation of the mineral from the gangue is attempted in the emulsifiers.

Q. 152. Are there any spitz boxes connected with these first agitators that you call emulsifiers?

A. No, sir.

Q. 153. They are simply agitators?

A. Simply agitators.

Q. 154. Then, where is the pulp taken?

A. Then the pulp is taken into machines that are called roughers, by virtue of the fact that they produce a rough concentrate, or a low grade concentrate, and after being passed through the roughers—it might pass through one or four or a large number, according to the material treated——

2448 Q. 155. Those are provided with spitz boxes?

A. With spitz boxes, yes; some are single Spitzkasten and some are double, according to the character of the material. After the feed has passed through the roughers, the reject or gangue constitutes the finished tailing of the flotation operation. The froth or concentrate is called the rough concentrate, and that constitutes the feed to the third group of machines, which are called the cleaners.

Q. 156. That is an entirely separate apparatus?

A. An entirely separate apparatus, but of the same character somewhat; they differ a little according to the kind of work they have to do. The cleaners receive the rough concentrates, and they make a separation in somewhat the same manner, and the froth from the cleaners constitutes the finished concentrate of the flotation operation. The tailings or reject from the cleaners is generally, if not always, returned to the roughers, mixed with the initial feed, that is, it goes back and joins the original feed again, and passes through the roughers, sometimes going through the emulsifiers, and sometimes not, according to the characteristics of the plant, and so on, but anyway it joins the other stuff before the initial feed has been separated in any way.

Q. 157. Why is it that these cleaner tailings are returned to the head of the machine or to one of the roughers?

A. They generally contain a considerable more mineral
2449 contents than the average of the tailings loss from the roughing plant, consequently there is material enough in them to make them worth retreating.

Q. 158. They are too valuable to throw away?

A. Yes, sir, and we get other benefits too.

Q. 159. Are these returned cleaner tailings what you refer to as the circulating load?

A. That constitutes what we call the circulating load. The circulating load is the water and material and so on—oil and everything mixed—that is called the circulating load.

Q. 160. Is there any other circulating load in your plant, other than the returned cleaner tailings?

A. Sometimes we take the froth from the last machine in the cleaning apparatus and return that as a circulating load through the cleaner, but that is not always done. What we ordinarily term the circulating load is the cleaner tailings going back to the roughers.

Q. 161. Does this circulating load carry considerable quantity of oil, that is, compared to the solids in them and the water, all mixed with it; is there a considerable quantity of that?

A. We have found that it does.

Q. 162. Do you know how much oil in proportion to the solids, in a general way?

A. I can't say exactly the proportion of oil with reference to the proportion of solids, because our determinations have been made in a somewhat different manner. We have usually determined
2450 the circulating load in proportion or percentage of the quantity of initial oil added, and our figures are kept in that way.

Q. 163. Have you any idea as to what proportion the oil in the circulating load bears to the initial oil?

A. Our determinations vary very extensively, not absolutely reliable, but they have given us the impression—and I think it is fairly close—that about one-third of the initial oil in circulation. By that I mean that if you are using, for example, 25 pounds of oil—or say, 24 pounds to make it even figures—if you were using 24 pounds of initial oil, approximately one-third of that comes back as the proportion which constitutes the circulating load, and again passes through the roughing plant.

Q. 164. This adds to the amount of oil shown by the figures that you have submitted?

A. We have found that it has the effect of adding the quantity of oil, yes.

Q. 165. Now, in operating with these large quantities of oil which you have testified to in the mill, did you perform any operations of that kind in the laboratory, or have them performed, with large quantities—I mean at your plant at Hurley?

A. Yes, for a long time in our plant we kept a force of men on that kind of work and performed a great number of experiments on the various products, not only the material that is now
2451 being treated, but other products also.

Q. 166. And what was the result of your investigations in the laboratory with quantities of oil upwards of 20 pounds per ton?

A. The laboratory results were not very encouraging.

Q. 167. In what way were they not encouraging?

A We did not succeed in getting satisfactory metallurgical re-

covery in the laboratory with the big quantities of oil unless we used quantities considerably in excess of commercial possibility.

Q. 168. Haven't you made some figures as to why they were unsatisfactory and what amounts were unsatisfactory in the laboratory, metallurgically, barring out the cost?

A. Well, I have in mind a test conducted with the crude oil and the Jones oil, particularly the Jones oil to which I referred this morning. These were applied to the treatment of the vanner concentrate and in the laboratory it was necessary to use quantities up to 50 and 60 pounds in order to produce results.

Q. 169. When you say "results" do you mean results comparable with those ordinarily obtained in the mill?

A. Well, by that we meant in our work, results that looked encouraging commercially, from a commercial standpoint.

2452 Q. 170. And what happened when you used, say 21 pounds?

A. We didn't get very satisfactory results.

Q. 171. Did you try less than 20 pounds, too?

A. Yes, we did.

Q. 172. And what happened with less than 20 pounds of these oils you mention?

A. Well, we were able to get very fair results with less than 20 pounds, but of course we found it necessary to use the Barrett oil and other more active oils, perhaps, in order to get the results.

Q. 173. With under 20 pounds?

A. Yes, sir.

Q. 174. But under 20 pounds, with simply these two oils you mentioned—what were they?

A. I mentioned the California crude oil and the Jones oil.

Q. 175. Yes. Now, with under 20 pounds of California crude and the Jones, without the assistance of the Barrett or anything else, what kind of a result did you get?

A. Only fair.

Q. 176. And then just what do you mean by "only fair?"

A. Well, we either got a very poor recovery or we got a very poor tailing.

Q. 177. And were the results acceptable commercially, in either event?

A. No, not with the Jones and California oils used in small quantities, in the laboratory, they were not.

2453 Q. 178. But with 50 or 60 pounds of this Jones crude and the other oil, you were able to get a fair result, you say?

A. Yes, sir.

Q. 179. A commercial result, was it?

A. Not commercial, because of the big quantity of oil.

Q. 180. Simply on account of the cost of the oil?

A. Yes, sir.

Q. 181. I understand. Now, how did the results in the laboratory that you have just described with this California oil and the Jones oil, compare with the results in the mill?

A. Well, we are finding that we are—Well, we are getting actual

commercial results with these same oils or with the Jones oil, in our vanner concentrates plant, with quantities varying from 20 up to 30 pounds. It varies a good deal from day to day.

Q. 182. And is that what you said you could not do in the laboratory, is it not?

A. Yes, sir.

Q. 183. To what do you attribute this difference between the efficiency of these oils in the laboratory and the mill? Have you any explanation?

A. Well, I think it is due mostly to the benefits of the oil in circulation; that is, we get the oil back from the cleaner tails and that oil serves some benefit in assisting in the oiling of the pulp in the initial feed.

Q. 184. When you referred to getting results with 20 or
2454 30 pounds of Jones oil, you meant 20 or 30 pounds of initial oil?

A. Yes, sir, initial oil.

Q. 185. And when you refer to circulating oil, you refer to this oil, and in placing the amount of oil in the machine?

A. Yes, sir.

Q. 186. That did not take place in your laboratory operations, of course?

A. We didn't get the same results in the laboratory.

Q. 187. Are your laboratory operations of continuous character or simply intermittent in service?

A. These were intermittent in service.

Q. 188. Is there any difficulty in maintaining the necessary oil supply, or obtaining it for operations with large quantities of oil, or can it readily be purchased?

A. We have had no trouble in getting sufficient quantities of oil for our vanner concentrate plant, in which we are using the Barrett oil and the Jones oil; but we have had a great deal of difficulty in getting sufficient quantities of oil for the roughing plant operations, or as we referred to them this morning as the plant in which the slime vanner tailings are treated.

Q. 189. What is the nature of that difficulty?

A. Largely a shortage of tank cars and then a shortage of storage capacity at our plant because we could not determine just exactly which of the half dozen different oils were going to be really the very
best for our operations and we did not want to lay in a big
2455 stock of all of the kinds; so we had to gather up oil from different places and we had a great deal of difficulty in some instances in getting the tank cars and in getting the oil delivered, so it has taken quite a little time to get the matter under way.

Q. 190. Now, in these figures which we discussed this morning and which appear upon the two tabulating statements which you used, the oil is given in a column here, "initial oil."

A. Yes, sir, on both tabulations.

Q. 191. "Pounds per ton" on both tabulations, which are exhibits 23 and 28, I think. Do the figures given in these columns represent

the new oil added for each ton of new feed that goes into the machine, without reference to this circulating oil?

A. Yes, sir, that represents a computation between the total weight of the dry material treated and the total weight of the oil that we actually consumed or actually took out of the tank.

Q. 192. Upon this table giving the details of the treatment of the slime vanner tailings I notice near the lower right hand corner, two figures, two numbers under a heading at the top of the page "Oil in circulation, load, pounds per ton." What do these figures represent and how were they obtained?

A. They represent samples taken of the circulating load during that particular day, and if my memory serves me correctly the samples were taken every two hours during the 24, and then that material was analyzed for oil and we found that the quantity of
2456 oil contained in the circulating load was equivalent to 3.2 pounds per ton of total feed to the machine.

Q. 193. On April 4th, that is?

A. Yes, sir.

Q. 194. Then in the next column which is headed "Total oil, pounds per ton," I note the 11.3, which seems to be the sum of the circulating load and the initial oil.

A. Yes, that is the sum.

Q. 195. That for the periods represented in this table which I have not mentioned, nothing appears in the column or in the circulating load, pounds per ton. I take it that no determinations were made, except on these two days when the figures appear?

A. No, sir. We made a determination on January 7th, but we were not satisfied that our method was correct, so we entered it as an approximate quantity. The other days no determination was made.

Q. 196. Was there a circulating load present on these other days when no figures appear?

A. Yes, at all times there was.

Q. 197. Referring again to this statement of the treatment of slime vanner tailings, I will ask you whether the material treated as reported upon this table was selected material, or was it material taken indiscriminately from the supply?

A. Well, you can make no selection in our plant of material; we have to treat what they send us.

Q. 198. This was representative of the slime vanner tailings, was it?

2457 A. Yes, I believe it was a very fair representation about an average of all the material.

Q. 199. Was there any attempt made to do otherwise than take the material just as it came?

A. No, sir, we took it out in the regular way.

Q. 200. How do these froths compare in appearance, those that are made with larger or smaller quantities of oil, above and below one per cent, say?

A. Well, it depends on the oil used.

Q. 201. Well, you might give us some instance of the particular oils?

A. We have found that the Taft oil which I referred to this morning, and that the sulphur oil to which I referred which was used on April 2nd—we found that the froth of those oils is almost identical with the froth obtained with the use of less than a pound of Barrett's creosote, when the Barrett's creosote is used alone; in fact I doubt very much if any one going into the plant could distinguish between the two oils, except possibly by the odor.

Q. 202. But some oils you said, I believe, do show a difference in appearance when used in small quantities?

A. Yes; we found that the Jones Fuel oil, which we have found particularly good on the treatment of slime vanner concentrates, is not in any way satisfactory in the treatment of slime vanner tailings, because it produces such a voluminous froth, while it produces a recovery, that it presents more difficulty in treating it in the cleaners.

2548 Q. 203. Then that is its difficulty, when the froth is too voluminous? The difficulty in handling it?

A. Yes. The froth gets entirely out of bounds. It runs out over the launders, and the feed pipes are not big enough and the circulating pipes can't handle it, and we can't handle it in our settling tanks or any place else.

Mr. Scott: That is all.

Mr. Garrison: We now move to strike out the testimony of this witness, the basis of our motion being the statement of counsel for the defendant on page 240 of the transcript of the minutes, where Mr. Scott in his statement to the court as to what he purposed proving by this witness said: "The testimony which this witness was about to give would have shown that in practical operations the processes of the prior art are practical and are profitable."

On page 243 of the minutes, your honor said, speaking to Mr. Scott:

"The argument this morning seems to be that you cannot introduce testimony of what you can do now without its relation to the prior art.

"Mr. Scott: The evidence that I propose to introduce now is a duplication of the prior art, merely showing its practical application on a practical scale. (Then a sentence which I will not read).

"The Court: This witness whom you have on the stand, and by virtue of the question that you had proposed, and others, we will say, like it, are you proposing to show the prior art and what may be accomplished by it?"

2459 And the answer was: "Absolutely." Now, we say he has absolutely refrained from showing anything as to the prior art, and under the circumstances his testimony should be stricken out.

Mr. Scott: I do not propose to examine this witness as to the literature of the prior art. The patent specifications are in existence. I propose to examine this witness on the facts, which will enable an expert to pass his opinion on whether those prior art principles are

practicable, and the expert witness cannot do that until I have the facts for him to pass upon.

The Court: What principle of the prior art do you apply this to; you have not shown what particular proce s this is.

Mr. Scott: Well, I will take one instance of the prior art. The California Journal of Technology, for instance——

Mr. Garrison: It is not in evidence.

Mr. Scott: I cannot present the whole case at once. One witness at a time is all we can have. The California Journal of Technology about a year and a half or two years before the patent in suit—in that we have a discussion of what is called the Elmore Bulk Oil Process. These writers go on to describe what they have discovered, as follows: They state that if the ore be powdered and mixed with water and oil, and in proportion varying in their different operations, from two per cent to seven or eight per cent—they have a series of experiments—then the mixture is violently agitated, the agitation will have the effect of beating up the mixture so that a foam
2460 or froth arises, carrying the mineral. They go on to discuss the permanency of this froth, its effectiveness in concentrating the ore, and in other ways describing the properties of the operations that are carried out today, in a clearer and more concise and more perfect terms than appears in this patent in suit. Now, there is not the slightest deviation between what this witness testified to and what is set forth in that journal. The journal states that the mixture of ore, water and oil as the witness has described it. The journal describes the agitation as the witness has described it, and after that agitation the formation of a froth—after the ceasing of the agitation the formation of the froth with its abundance of air bubbles, the air bubbles carrying the mineral, the same as he describes it. The publication describes the permanency of this froth and its general characteristics as described by the witness. In every respect it conforms. Now, if we were able to present two witnesses simultaneously, I could have met Judge Garrison's objection; otherwise it is impossible. There are the facts, and there is the publication in evidence; and as soon as the orderly presentation of the case permits, what the witness has testified to will be connected with the disclosure contained in this publication. I don't know that this witness ever saw the publication; he may, or he may not.

Mr. Garrison: From what I just read of the proceedings, it is quite obvious that my purpose was perfectly clear, to elicit from counsel for the defendant whether he purposed to give this testimony in this way, which he now says he intended, or whether he
2461 purposed by this witness demonstrating the state of the art and the practical operation of the same before, and, he, in answer to your honor's question, said that he absolutely intended to do the latter. Now, he absolutely has not done the latter, and we are left in the very situation which I feared. We have not as yet any evidence as to the prior art, which he says they are going to connect this with; we have not yet any evidence in the exposition of that by an expert which he says he is going to produce, to give us a clear understanding of it; so that your honor will observe that it is

absolutely impossible for us to cross examine this witness intelligently now because every question that we would ask him would have to be referred to an expert for him to answer. We cannot ascertain from this witness whether or not this illustrates the prior art, because this witness has not been qualified to testify to the prior art, nor has anybody else. So, if your honor is not going to strike the testimony, then we most respectfully request that our cross examination may be postponed until after the expert witnesses have testified in respect to the prior art, to connect it with this testimony.

Mr. Scott: Counsel is at liberty as fully now as he ever will be to cross examine this witness about what he has testified to. It is not competent to cross examine this witness about prior art, because he has not testified about prior art; he has testified about certain operations. When our expert witness testifies and illustrates the prior art, then counsel can cross examine the expert about the prior
2462 art. There is no use postponing this cross examination so that the witness can be cross examined about something that he did not testify to. He has testified to facts, and he can be cross examined now as well as any other time, and I see no reason for disturbing the orderly conduct of the case for the simple reason that counsel cannot now cross examine the witness on something that he has not testified about, and that is what the entire objection amounts to.

The Court: This witness has testified merely to facts which he claims he knows of his own knowledge and from his own operation or the operation of the plant with which he is connected, and has not assumed, himself, to know anything about the prior art; he has told us nothing about it. The statement of the defense is that they will eventually show that what has been done by this witness, as described by him, is a part of the prior art. I think the order in which we are proceeding is satisfactory. As to the cross examination, I cannot see any reason why you cannot cross examine him fully, because he has only testified to his own acts. You may proceed, and if later you want to question him further, you will be given the opportunity. At this time the motion to strike will be denied. Of course, if it appears later on that it has no relation to the prior art, the motion to strike out may be renewed. You may proceed.

Mr. Williams: Before proceeding with the cross examination of this witness, I would like to request of counsel for the de-
2463 fendant that we be supplied with specimens of the material of which this witness has testified, the vanner concentrates, the vanner tailings, and the various oils used, which have simply been denominated by their commercial names. May we have those?

Mr. Scott: These operations extended over two and a half years, but as far as possible we will supply you with anything, and furthermore we should be very glad to have you visit the plant, if you have any objection to this testimony, as you have signified, on account of not having been present during the two and a half years that the witness testified to. We make the offer today that you may

visit the plant now, and as far as possible we will supply you with the material asked for.

Mr. Williams: How many days would it take to go to the plant and spend a couple of days there, and delay the trial?

Mr. Scott: It was absolutely impossible to have you there during the last two and a half years.

Mr. Williams: How soon will you give us the samples?

Mr. Scott: As soon as possible.

Mr. Williams: I think it will be impossible to finish cross-examining until we have had an opportunity to examine the characteristics of this material about which the witness has testified.

The Court: Proceed with the cross examination.

2464 Cross-examination.

By Mr. Williams:

X Q. 204. Mr. Wicks, you say you have been associated with mill and metallurgical companies for about twelve years?

A. Yes, sir.

X Q. 205. And that carries you back exactly to what time?

A. To the fall of 1905, I think, or 1906—I will have to figure it back, because I remember the number of years' connection with each plant—I think it was in the fall of 1906 when I first became connected with metallurgical operations.

X Q. 206. And at what plant?

A. I was first employed at what is now the Midvale plant of the United States Smelting & Refining Company.

X Q. 207. And what was your position there?

A. During the first part of the time I was doing clerical work under the direction of the master mechanic; and then, before the plant closed down, which it did in 1907, I was made assistant master mechanic.

X Q. 208. And your work was in the mill?

A. No, only part in the mill there; we had a small mill there, and my work was scattered throughout the plant, which was a mill and smelter and all that goes with it.

X Q. 209. You had nothing to do with flotation at that time?

2465 A. No, sir, nothing at all.

X Q. 210. Then you say that during the next five years your duties were both mechanical and metallurgical. Was that in the same plant?

A. No, sir, I was with the Utah Copper Company at the Garfield plant.

X Q. 211. What was your position during that time?

A. I had the title of plant engineer during most of the time that I was there, in fact I did during all the time except the first two or three months, while they were trying me out.

X Q. 212. That would run from 1908 to 1913?

A. I went there in April in 1908, and my connection with the Utah Copper Company ceased in November, 1912.

X Q. 213. Any experience with flotation there?

A. Experimentally, only.

X Q. 214. During what part of the term of your employment?

A. I can't recall just when it was that we first began to give consideration to flotation. I know I had been there a number of years—or at least I had been there some time when flotation was first discussed as far as I know. Of course my position was pretty much subordinate there, and there were lots of things going on around the plant of which I did not know anything. But it was sometime after I had been there, I know, that flotation was first discussed.

X Q. 215. Then you said that in the next three years you had supervision over mill operations. Where was that?

2466 A. At Butte; at the Butte and Superior Copper Company, now——

X Q. 216. (Interrupting.) "Now Mining Company." And now, what was the period of that experience?

A. I came to Butte in October, 1912, but I did not become associated with the company until December of 1912.

X Q. 217. And then you continued with them?

A. I continued with them until April of 1915.

X Q. 218. You had supervision over their mill?

A. I was mill superintendent.

X Q. 219. Mill superintendent of the Butte & Superior Company for a period of three years?

A. Yes, sir.

X Q. 220. I presume you had quite some experience with flotation?

A. Considerable.

X Q. 221. When you came to work there, the flotation plant was installed?

A. It was operating intermittently.

X Q. 222. At Butte?

A. Yes, sir.

X Q. 223. And when you left the Butte and Superior Company where did you go?

A. Went to the Chino Copper Company.

X Q. 224. And your position there?

A. Is, as I have said, the assistant superintendent of mills.

X Q. 225. What education had you had in metallurgy and mining and milling?

2467 A. My education extends only through the high school course, so far as actual schooling is concerned.

X Q. 226. Not in any technical school?

A. No, none at all, sir.

X Q. 227. So that your technical knowledge has been acquired by experience?

A. And continuous study.

X Q. 228. You are familiar with the mill operations in the flotation plant at Butte?

A. I had supervision over them, yes sir.

X Q. 229. And I presume that involved the direction of the operations by receiving reports of the operators and studying the operations?

A. Yes, sir, to a considerable extent.

X Q. 230. About what proportions of oil were used in the Butte plant when you were in charge of the milling?

A. Well, we used a number of different proportions. I can't recall the figures off hand, because it was so long since severing my connection with the company, but we used various quantities.

X Q. 231. You used six pounds to the ton at times, did you not?

A. We went considerably higher than that, if my recollection is right.

X Q. 232. And your results were not very satisfactory when you went so high?

A. Well, that is rather difficult to answer.

X Q. 233. When did you first acquire a knowledge of flotation concentration of ores?

A. I began to study it along in the early part of 1912—
2468 and while I had had a general knowledge of it before, I hadn't had any special knowledge, but I began to give it a considerable study in 1912.

X Q. 234. That was just prior to your employment by the Butte & Superior Company?

A. Yes, sir; I rather anticipated that I would have use for that information, and, while I had read a good deal on it prior to that time, kept up with the general progress of events, as all intelligent men do, I did not give it any special study until along in 1912.

X Q. 235. Well, first, when did you give it any study?

A. I can't remember.

X Q. 236. During the early years, say the first two years of your experience in connection with mining and milling, what did you know or learn about flotation?

A. That is too far back, I can't remember that.

X Q. 237. I show you plaintiff's exhibit 9, what appears to be a copy of a letter signed by you and addressed to Mr. F. G. Janney, manager of mills, Utah Copper Company. Do you recognize that as a copy of a letter written by you, or as the original letter, whichever it may be?

A. Yes, sir, I recognize my signature; I can identify this letter.

X Q. 238. How did you come to address it to Mr. F. G. Janney, manager, of mills, Utah Copper Company, when it appears to relate to the affairs of the Butte & Superior Company?

A. I don't know what Mr. Janney's connection was with
2469 the Butte & Superior Company, or whether he had any actual connection, but I know that it was upon Mr. Janney's recommendation that I was transferred to Butte, and he guided me through the first months of my work here, and I frequently consulted with him.

X Q. 239. Well, isn't this a report about the affairs of the Butte & Superior Company?

A. Yes.

X Q. 240. The letter is a description of Mr. Hyde's connection with the Butte & Superior flotation operation, is it not?

A. So far as the operations go, yes, it is.

X Q. 241. How did you come to make this report?

A. He requested me to do so.

X Q. 242. I read from this letter of yours: "Green has been running a number of tests on the flotation feed to determine the benefit derived by allowing the pulp to stand for a period of time in contact with a weak solution of acid before treatment. He finds that whenever he allows the flotation pulp to stand for an hour or more, with the addition of two pounds of acid per ton of solids that he gets a good tailing and a good concentrate, in the laboratory machine, regardless of the percentage of slimes and using from four to six pounds of oil per ton of ore. His tests have been so successful that we are now preparing to handle the mill pulp in this manner." Does that refresh your memory as to the operations in the mill using from four to six pounds of oil to the ton of ore?

A. My recollection is that at that time represented a de-
2470 crease in the quantity of oil rather than being representative of what we had actually been using.

X Q. 243. But this letter says: "We are now preparing to handle the mill pulp in this manner. Did you do so?

A. I don't remember whether we did or not. I know that we tried out that scheme of adding acid sufficiently far ahead of the flotation operation and, if my memory serves me correctly, that worked out very nicely, but as to the amount of oil, I do not know.

X Q. 244. Well, how much do you think it was, about?

A. I wouldn't venture to estimate because I haven't the figures, and a good many things have taken place since then.

X Q. 245. Hadn't Mr. Janney come to the Butte mill to help out in the operation before this letter was written to him, Mr. F. G. Janney?

A. I think so.

X Q. 246. But you don't know that he then had any actual connection with the Butte & Superior Company?

A. I don't know just what his connection was, but I know that he more or less directed my work during the first month of my operations at Butte.

X Q. 247. And this was on September 16, 1913, after you had been there some time?

A. Yes, sir, I had been there several months, yes, sir.

X Q. 248. Now, can you say that at any time up to we will say September 16, 1913, in the Butte and Superior mill, you used,
2471 in commercial operations, about four pounds of oil or six pounds of oil to the ton of ore?

A. I don't see that I would be expected to remember these figures because that is a long ways back. I have no doubt but what the records that I kept at that time will show.

X Q. 249. Will you give me your best recollection on that question?

A. At what particular time?

X Q. 250. Up to September 16, 1913, the date of this letter.

A. That is the average of all of it?

X Q. 251. No, no, whether at any time during that period you used in commercial operations in the Butte & Superior plant, either four pounds of oil to the ton of ore or six pounds of oil to the ton of ore.

A. I have my doubts about ever having operated at that low a figure.

X Q. 252. What is your best recollection as to figures that you did operate on, we will say the lowest figure that you did operate on?

A. I would have to refer to the records, Mr. Williams; without them, I couldn't offer an estimate.

X Q. 253. Will you look up the records and endeavor to answer the question that I have put to you and that your memory does not enable you to answer?

A. Well, I have no connection with the Butte & Superior Company now.

X Q. 254. Yes, but you are testifying for the Butte & Superior Company, and it may be that they would be kind enough to
2472 let you have access to their records of the time when you were superintendent of the mill. Will you endeavor to do so?

A. I will endeavor to do so, but I can't promise to produce them, because I have no connection with the company; no authority to do so.

Mr. Williams: Will counsel endeavor to overcome the difficulty of the witness in getting access to the records of the work done by him?

Mr. Kremer: When the witness makes the request we will see.

Mr. Williams: Well, I make the request of you; please see that the witness is supplied with the information?

Mr. Kremer: I can't promise you, because I don't know its availability.

Mr. Williams: If available, you will endeavor to give the witness an opportunity to examine those records? Is that right?

Mr. Kremer: If it is available in such form that he can get a complete examination, it will be done; otherwise it will not.

Mr. Williams:

X Q. 254½. You testified about certain operations on November 18th, 19th and 20th of 1916, when the amount of oil used was 23.70 pounds to a ton of ore. Is that correct?

A. Yes, sir.

X Q. 255. You did not describe the oils that were used on that occasion. Will you please do so?

A. We used a combination of Barrett's No. 4 creosote oil and Jones' flotation oil.

2473 X Q. 256. In what proportion?

A. I can't say the proportion. Our records do not show.

These proportions are varied from time to time because they are added separately and they are added at the discretion of the operator.

X Q. 257. How are you able to testify as to the oils that were used at that time?

A. The quantities are measured directly and the quantities missing or disappearing from the tanks are checked against the reports of the various foremen, and the various foremen make the measurements themselves in this particular case.

X Q. 258. What is your record of the particular oils that were used there?

A. Barrett's No. 4 and Jones' oil.

X Q. 259. What is your record of that? I don't see it in the slip that you have handed me.

A. We have not shown that in that slip; it wasn't considered essential there.

X Q. 260. Have you a record of it?

A. Yes, sir.

X Q. 261. On another document?

A. Yes, sir.

X Q. 262. What is this other document which contains this record that does not appear on the one put in evidence?

A. This is an entry of the results obtained each day during the month of November, in this particular plant. That shows there simply just the summarized results.

Mr. Williams: I am going to request counsel to give us
2474 access to this detailed statement which gives particulars that do not appear on the one put in evidence.

Mr. Scott: I think it is sufficient if the witness testified from these records. He has a great, voluminous record, which obviously can not be used to encumber this case. He will answer fully as to any information contained in that.

The Court: Counsel has a right to examine that if he desires.

(Whereupon counsel referred to the record held by the witness.)

Mr. Williams:

Q. This memorandum at the foot of the list that you have referred to, does that note "kinds of oil used, B" signify Barrett's No. 4?

A. Barrett's No. 4 creosote.

X Q. 263. J. Jones'; T turpentine; Ch., Chesapeake pine; is that descriptive of the oil used?

A. That was considered sufficiently descriptive for our purpose because these initials appeared here.

X Q. 264. Oh, then you had in a separate column the initials there describing such oils as were used at that time?

A. Yes, sir.

X Q. 265. And they show that you used this combination of B and J on November 4th, and so on continuously until November 28th, is that right?

A. Yes, sir.

X Q. 266. And on November 29th and 30th you do not
2475 seem to have any record of the kind of oil used; is that right?

A. I think that is an oversight. I think that was possibly Jones' and Barrett's oil, because there are no other oils called for except those that are called for up here. But I can verify that if necessary.

X Q. 267. How can you verify them?

A. By referring back to the records made by the various shift foremen, the pencil records that were taken.

X Q. 268. Well, never mind, then. I note that on November 25th the oil pounds per ton is 26.14. That is correct is it not?

A. Yes, sir; that is correct. I remember having referred back to that to make sure of it.

X Q. 269. And then on November 21st, the day after, the last three of these, the amount of oil was 17.16?

A. Yes, sir.

X Q. 270. And then on November 17th, the day before these three, the amount was 15.26?

A. Yes, sir.

X Q. 271. I note also that at the beginning of the month the amount of oil used was 8.06 pounds per ton. Is that true?

A. Yes, sir, I believe so.

X Q. 272. How do you account for the increase in the quantity of oil which really becomes manifest a day or two before these three that you have spoken of?

A. Well, partly because of the increase in the mineral content, or copper content of the material treated.

2476 X Q. 273. Does that show in the table?

A. Yes, sir; that does not account for all of it, however.

X Q. 274. That is to say, the concentrates were to some extent a little richer, that were fed to this plant?

A. On the 5th of the month, the copper content of the feed to the plant equalled 3.60% copper, but by the 17th of the month it had increased to 10.23% copper.

X Q. 275. And then on the 18th it dropped down to 9.02% copper?

A. Yes, sir.

X Q. 276. And the oil went up from 15.46 to 23.98?

A. Yes, sir.

X Q. 277. So that does not explain it?

A. Partly, yes. There are so many things that may affect it.

X Q. 278. Under whose direction was the amount of oil increased for that test, we will say, of November 18th, or that work on November 18th?

A. On November 18th—well, that was done under Mr. Wiser's direction, but was done by the various shift foremen in charge of flotation on the three shifts in the mill. On account of the variable character of the material treated they are allowed a great deal of discretion as to the proportion and kinds of oil that they use.

X Q. 279. You had not commenced, then, to intentionally in-

crease the amount of oil above 20% to see what you could get—20 pounds to the ton of oil, to see what you could do?

2477 A. We were trying to keep it down just as low as we could.

X Q. 280. At that time?

A. Yes, sir.

X Q. 281. Was that the first time in these operations that you ran up to above 20 pounds of oil to the ton of ore?

A. I am unable to say, but I think there are probably times when it went above that. I am not certain. Our metallurgists had been calling attention to the gradual increase in the quantities of oil and we had not been able to understand just what the reason was.

X Q. 282. One of the oils which, according to this table, was used on that day, is marked on the table, "Jones." What is its full commercial use?

A. I don't know; we call it Jones' flotation oil, but whether that is the commercial name or not, I do not know.

X Q. 283. Do you know whether it is known as Jones' fuel oil?

A. I am not certain. We always call it Jones' Flotation Oil.

X Q. 284. What kind of an oil is it?

A. It is a moderately heavy petroleum oil; it comes from some place in Kansas.

X Q. 285. Is it or is it not very nearly in its natural condition?

A. I don't know whether it has been put through a refining process or not, but I believe that it has.

X Q. 286. Is it a viscous oil or a thin oil?

2478 A. Somewhat viscous.

X Q. 287. What is your general recollection as to the proportions of Barrett's and Jones' oil that were used about the time of these operations, to wit, during the month of November?

A. Well, they varied a great deal from day to day. I know that the Barrett's oil generally constituted the major portion of the oil, but not always.

X Q. 288. Barrett's oil is a creosote?

A. Yes, sir; we have been calling it creosote; I think it is.

X Q. 289. What kind of an oil is it?

A. I believe it is a coal tar product.

X Q. 290. And where does that come from?

A. We buy it from the Barrett Company, and they ship it, part of it, from Chicago—I don't remember where they shipped the rest of it from, *but* I don't know where it is produced.

X Q. 291. It is the Barrett Company of Chicago?

A. It is the roofing company that goes by the name of "Barrett Company."

X Q. 292. And that is a sort of a thick, tarry material, is it?

A. No, sir.

X Q. 293. How would you describe it?

A. It is a fairly thin oil.

X Q. 294. And who do you purchase the Jones oil from?

A. George B. Jones & Company, I believe.

X Q. 295. Of?

2479 A. I don't know their address.

X Q. 296. Am I right in understanding that you have no record which will enable you to say what the relative proportions of Barrett and Jones oil were in the operations of November 18th, 19th and 20th, 1916?

A. I have no record here.

X Q. 297. Is there a record?

A. I think there is. The scratch records should show that. I haven't any doubt but that they will.

X Q. 298. Will you look up that record and arrange to have it sent here?

A. If you wish me to.

X Q. 299. And please be prepared to refer to the records for the purpose of completing those operations that you have testified to.

—. ——.

X Q. 300. On November 18th, 19th and 20th, of 1916, what in general were your mill operations? You have described them only in relation to the flotation plant. What was done with the ore up to the point that it entered the flotation plant?

A. I don't recall that there was anything special on those days.

X Q. 301. Well, what does the mill do with the ore before it reaches the flotation plant; describe it generally?

A. Well, we crush it and grind it and concentrate it on tables and regrind it in the usual manner, and then we treat it on vanners, either sand vanners or slime vanners or tables, according to the size and character.

2480 X Q. 302. But how finely do you grind the feed to the vanners?

A. I presume that there is very little feed—I haven't the record here, but judging from this book I presume that there is very little feed treated by the vanners that is coarser than twenty mesh.

X Q. 303. And the greater part of it is finer?

A. Yes.

X Q. 304. But you cannot give a screen analysis of the feed to the vanner?

A. I can produce them, but I haven't them in Butte with me.

X Q. 305. I think I would like you to let us have those?

A. You will understand of course that conditions vary from time to time.

X Q. 306. Well, how do the conditions since January 1st, 1917, compare with those existing in November, 1916?

A. There is no important change in that time.

X Q. 307. The changes that you speak of are merely adaptations from time to time to variations in the ore?

A. Partly, and partly to gradually increasing tonnage, or increasing capacity and efficiency and so on.

X Q. 308. You did not make any change in your grinding operations when you changed from less than twenty pounds of oil to more than twenty pounds of oil?

A. No, we made no difference in the grinding operations at all.

X Q. 309. Did you make any other change in the treat-
2481 ment of the ore before it reached the flotation plant as a result of the change in the quantity of oil, or in connection with it?

A. No, sir.

X Q. 310. So that the feed to the flotation plants would be on an average substantially the same with the more than the twenty pounds of oil as it was with less than twenty pounds of oil?

A. Yes. When we had these oils available, we simply put them in, and cut down the quantity of the other oil, without changing the method in any way, except that when we had to cut out certain portions of the plant in order to cut down the tonnage, so that we would have oil enough so that we could make a reasonably good run.

(Whereupon a short recess was taken.)

X Q. 311. Will you give me a description of the ore that is treated in the Chino mill?

A. It is a copper ore, low grade ordinarily.

X Q. 312. Running in what percentage of copper during the period of your knowledge, or the general average?

A. For what particular period, Mr. Williams?

X Q. 313. Well, take the period while you were there?

A. I can tell you approximately in a few minutes—well, a little under two per cent.

X Q. 314. And what percentage of that is sulphide?

A. The proportion of sulphide varies from time to time. I am unable to say just what the average proportion of sulphide is.

2482 X Q. 315. Give it the other way; what proportion is oxidized?

A. My answer would be the same, the proportion of oxidized or carbonate material varies from time to time.

X Q. 316. The oxidized is usually in the form of carbonate?

A. Part of it is.

X Q. 317. Any silicate?

A. I have seen specimens of silicate in the ore at various times.

X Q. 318. Is your oxidized ore a dead loss in your flotation operations?

A. Not entirely so.

X Q. 319. You float some of it?

A. I think we do.

X Q. 320. You have not any exact determinations?

A. We have not any exact determinations on that, no, sir.

X Q. 321. What else does your ore contain besides sulphide of copper and oxidized copper?

A. It contains some native copper.

X Q. 322. Do you recover that by flotation?

A. I think we do a little, but it is exceedingly difficult to make any determination of that, because the material going into the flotation plant is so fine that I know of no satisfactory way of making a metallic copper determination of it.

X Q. 323. There is not very much metallic copper I suppose?

A. The major portion of the metallic copper comes out in the tabling operations.

2483 X Q. 324. What else besides native copper, sulphide of copper and oxidized copper?

A. Some cuprite.

X Q. 325. And what is cuprite?

A. That is an oxide of copper.

X Q. 326. What are the gangues?

A. Principally silicious gangues.

X Q. 327. In what condition do you find that gangue as you treat it in the flotation plant?

A. In what size, you mean?

X Q. 328. Yes. Is it colloidal?

A. A large part of it is as near as we can determine.

X Q. 329. How do you account for the fact that so much of the oxidized copper goes with the slimes tailings from the vanner, and so little apparently with the finest concentrates?

A. Largely because of its relatively lighter character; that is, it is more nearly the gravity of the gangue than the sulphide is.

X Q. 330. Is there any material that you would call clay in ore?

A. Yes, sir.

X Q. 331. Is the silicious material of a clayey nature?

A. I never thought of it in exactly that way. Some of the gangue is true quartzite and some of it is granite and some of it is porphyry.

X Q. 322. Have you any record of the exact analysis, complete analysis of your ore?

A. Of the crude ore, no, sir.

2484 X Q. 333. Will you let us have a specimen of your crude ore; that is to say, a specimen that has not been wetted, so that an analysis may determine the condition of the crude ore; dry ground?

A. Dry ground to what fineness?

X Q. 334. Crushed to a quarter of an inch?

A. If the attorneys are willing for me to do so?

Mr. Kremer: We have no objection. We will be very glad to have him do it if he can.

X Q. 335. You have the permission. Will you do so?

A. I will endeavor to do so.

X Q. 336. In the operation of your flotation plant since December 20th, 1916, what speed of agitation have you used in the Janney flotation machines that you have described?

A. We used the same speed that we were using before we made no change in that.

X Q. 337. And what is that speed?

A. The flotation machines are driven by alternating current motors which have a synchronous speed of 600 revolutions a minute. I presume they actually operate at around 560 or 565 revolutions per minute.

X Q. 338. That is, under the conditions of load?

A. Yes, and under the various electrical conditions obtaining in the plant.

X Q. 339. What is the diameter of these agitators?

A. I don't remember the diameter—let me understand you; do you mean the diameter of the agitator or of the agitator cell?

X Q. 340. The diameter of the agitating blades?

2485 A. I think that they are about eight inches and twelve inches but I would not say for certain, because I don't remember.

X Q. 341. Have you working drawings of these Janney machines?

A. I haven't them here.

X Q. 342. Can you produce them—as I recollect you were asked and said that you would. Are you able to produce them?

A. If the attorneys are willing I haven't any doubt that they can be produced. I will endeavor to do so with their permission.

Mr. Williams: Will you produce working drawings of the Janney machines used at the Chino plant?

Mr. Kremer: We have no objection to their being produced.

Mr. Scott: I will get the witness to make you a sketch. I don't know what information he has at hand——

Mr. Williams He cannot give the dimensions without the working drawings.

X Q. 343. The lower agitator is of less diameter than the upper, is it not?

A. I think so.

X Q. 344. Because the lower agitator revolves alongside the baffles and the upper agitator revolves above the baffles, is that right?

A. Yes, sir.

2486 X Q. 345. I understand that the blades of the agitator are on a shaft which extends down from the motor?

A. Yes.

X Q. 346. And that the speed that you have given for the motor is the speed of the agitators, is that right?

A. That was my intention, yes, sir.

X Q. 347. Now, you have not said anything about temperatures in any of these operations that you have described. At what temperatures have you operated during your experience in this Chino mill?

A. We do not make any record of the temperatures.

X Q. 348. Do you heat your pulp?

A. Occasionally we have heated the pulp leading to the plant which treats the low grade vanner concentrates, but only to a very limited extent, and as far as I can remember it has been a number of months since that was done.

X Q. 349. Now, take the operation since December 21st, 1916?

A. I feel fairly confident that there has been no heating done during that period, nor for several months before that.

X Q. 350. And when you did heat, you applied your heat to the

feed to the flotation plant which treated the vanner concentrates, is that right?

A. Yes.

X Q. 351. And you never applied heat to the feed to the flotation plant which treats the vanner tailings, is that right?

A. Yes. We have never tried that.

2487 X Q. 352. How about the thickness of the pulp used during the time that you have been connected with this mill?

A. The thickness of the pulp varies a great deal from time to time. If you wish any specific time I probably could give you that information.

X Q. 353. Give me November of 1916 first, and then give me some operation since December 20th, 1916?

A. In November, 1916, the average dilution of the pulp, or average per cent of solids, which is the way that we keep it, was 37.03 per cent solids in the pulp.

X Q. 354. I note now looking at this table that the lowest percentage of solids to pulp occurred on the days November 18th, 19th and 20th. That is true, is it not?

A. No, that is not true. On the 28th there was 29.48 per cent solids in the feed, as compared with the 18th and 19th, a greater quantity of solids in it.

X Q. 355. And with that single exception the run was much higher for the percentage of solids in pulp?

A. I will call attention to the 25th, when the percentage of solids was 33.2, which was lower than these two days, although higher than the third day.

X Q. 356. And it was on that day that your oil went up to 26.14 pounds to the ton?

A. Yes.

X Q. 357. So there seems to be a relation between the percentage of solids in the pulp and the percentage of oil used; that is true, is it not?

A. The matter has not been called to my attention before.

2488 There might be some relation there which I have not discovered.

X Q. 358. Does not it appear so from those tables which you have before you?

A. I would have to compare them pretty extensively before I would be able to say.

X Q. 359. Well, take the other low figure of the percentage of solids, and you find the pounds of oil was 18.41. That is right, isn't it?

A. Yes. There may be some relationship there.

X Q. 360. And we find on the first day of the month 8.06 pounds of oil per ton, and percentage of solids 46.43—I think that last figure is 3. Is that right?

A. Probably it is 46.43. It does not matter really. Yes, sir.

X Q. 361. And for November 18th, we find the percentage of solids, 30.53; November 19th 32.10, November 20th, 26.92. That is true, is it not?

A. Yes, sir.

X Q. 362. Could you supply us with a flow sheet of your mill?

A. I have no authority to give out the flow sheet of the mill, Mr. Williams.

X Q. 363. Could you supply us with a flow sheet of the flotation plant?

A. I have no authority to give out any of the flow sheets.

X Q. 364. But you have described the flow of the material. Can't you let us have an accurate official drawing, such as every mill has, showing just exactly what those flows are?

2489 A. I would have to get permission from the general manager, under whose jurisdiction I am.

X Q. 365. Who is your general manager?

A. Mr. John M. Sully.

X Q. 366. Did he give you permission to come here and give evidence.

A. He was away from the plant when I left.

X Q. 367. Will you endeavor to get that permission and produce those flow sheets?

A. I will ask him if he is willing for them to be presented.

Mr. Williams: Counsel gives notice that unless the witness produces the official flow sheet, motion will be made to strike out all of his testimony in relation to the flow of material in the plant, and that covers about the whole of his testimony.

Mr. Kremer: We, of course, cannot restrain counsel from making motions to strike, but at this time we state that the witness is upon the stand, and if he is desirous of knowing anything about the flow sheets, he can ask any questions that will call from the witness a response that will describe the flow sheet or the operation of the mill. It is not incumbent on the witness to furnish a picture.

X Q. 368. Have you got that flow sheet here?

A. I am not certain whether I have or not. I will look—I have one covering a portion of the mill dated January 3rd, 1917.

X Q. 369. Does that include the flotation part?

A. No, sir, this is the concentrating department. It shows

2490 the upper end of the preliminary operation of the flotation plant, merely as a connector, so as to show where the products from the concentrating department go.

X Q. 370. So that it shows the flow of the material up to the flotation plant, and the commencement of the flotation plant?

A. Yes, it shows the emulsification into the flotation plant.

X Q. 371. Will you supply, or permit us to make a copy of that flow sheet?

A. I don't feel that I have authority to do so. It is the property of the Chino Mining Company. With permission I should be very glad to do so.

Mr. Williams: I ask the court to order that we have permission to examine that flow sheet.

The Court: What is this?

Mr. Williams: The flow sheet of the mill, showing the manner in which the material is fed to the flotation plant.

The Court: Yes, you have it here within the jurisdiction of the court. You will furnish it to the counsel. It is material on cross examination.

Mr. Kremer: Of course we have no objection to it whatever. We believe that the statement of Mr. Wicks, appearing of record, will sufficiently protect him in the matter.

X. Q. 372. You have stated that the finer concentrates of the vanner go through the flotation plant. Is that correct?

2491 A. The finer portion, I said.

X Q. 373. What becomes of the coarser portion?

A. That is treated on the tables.

X Q. 374. Does that ever go to the flotation plant?

A. I think not.

X Q. 375. Does this flow sheet show what becomes of the coarser concentrates from the vanners?

A. I think that the flow sheet simply shows that it goes to the vanner concentrate retreatment plant. That is a plant which has classifiers, tables and so on. It simply makes notes on the bottom of the flow sheet that the material passes to the retreatment plant; that is all.

X Q. 376. Where do you add the oil to the pulp in your operations, and if there was any difference before December 21st, 1916, and afterwards, you can explain?

A. As far as I know there is no difference at all, except that in some cases more emulsification was necessary than others.

X Q. 377. Where do you add the oil?

A. Ahead of the emulsifier.

X Q. 378. Between the emulsifiers and the vanners.

A. Well, directly ahead of the emulsifiers, which of course puts in between those.

X Q. 379. You have not any regrinding between the vanners and the flotation plant there, have you?

A. No, sir, not at this time.

X Q. 380. Did you at any time?

A. We never have had.

X Q. 381. Why did you say not at this time?

2492 A. Because we are preparing to regrind the sand vanner concentrates. That is something we have not discussed yet. We are preparing to regrind them, and if possible treat them by flotation.

X Q. 382. And to add oil during the regrinding?

A. That has not been worked out yet, Mr. Williams; we have not decided.

X Q. 383. But you do not do anything of that sort, and have not done anything of that sort during the period of your experience at the mill?

A. You mean adding oil during regrinding?

X Q. 384. Yes.

A. Well, there is always a little oil present in all the circulating waters all through the plant, but we do not go up above the grinding machines and deliberately add oil for the purpose of adding oil to the pulp; but there is always a little oil present.

X Q. 385. That is to say you have a circulation of water from the tailings back to some part of the mill?

A. Yes.

X Q. 386. Just describe that please?

A. Well, the desert conditions in that country make it necessary to conserve the water supply by impounding the tailings and returning the water, and that water which is so circulated represents the major portion of our water supply.

X Q. 387. In practically all parts of the mill?

A. In all parts except where absolutely clear water is required.

X Q. 388. Have you ever made any analysis of that water,
2493 the circuit water, to determine what was in it by way of contamination?

A. We have endeavored to do so, but we never have taken any long drawn-out samples or for any long period, samples for the purpose of analyses. I think we have made analyses from time to time, but whether they are complete or not, I don't know.

X Q. 389. What generally do they show as to the condition of that circuit water?

A. They show a certain acidity in sulphuric acid and in copper sulphate in solution, and considerable ferrous or ferric compounds.

X Q. 390. Phenol and cresol?

A. Sometimes.

X Q. 391. Is the oily reagent emulsified with this water before passing to flotation?

A. Sometimes.

X Q. 392. Not a general practice?

A. We find it necessary with some oils.

X Q. 393. And then it passes into the flotation plant and meets the circuit water? Is that right?

A. Let me understand what you mean by "circuit water."

X Q. 394. Circuit water is the water that has been down through the tailings and has been returned. Clear water is water that has not been through the circuit.

A. Well, of course some of this oil is mixed with circuit water, under that definition, before it goes into the flotation pulp, sometimes.

X Q. 395. But the point that you had in mind was that
2494 you sometimes agitate for specific purposes before the oil or reagent comes in contact with the ore. Isn't that what you had in mind?

A. Well, I had in mind oil distributed along the circuit water and circulating pulp or circulating loads, the reason I asked you for that definition.

X Q. 396. What do you call the circulating load—is that the term you used, "circulating load"?

A. That is the cleaner tailings returning to the rougher, as I explained this morning.

X Q. 397. What might well be called a return of middlings to the rougher?

A. Yes, it might be.

X Q. 398. Now, sometimes these middlings got to the emulsifiers; is that right, and sometimes they do not?

A. Yes.

X Q. 399. What oils do you have to treat with this extra emulsification?

A. Any oil that is viscous, that is highly viscous. That is, any of the so called low gravity oils.

X Q. 400. For example, among the oils that you have named.

A. The Taft oil of California.

X Q. 401. Now, in this matter of emulsification, what difference has there been, if any, before and after December 21st, 1916?

A. You are speaking of the vanner concentrate cleaner plant, of course?

X Q. 402. Yes.

2495 A. There has been no difference in the emulsification.

X Q. 403. And in the other plant. I notice you merely give in your list, certain operations on different days. Was that plant running right along?

A. Yes, it was.

X Q. 404. And under what conditions was it running? You haven't given that in your table.

A. To what plant do you refer, Mr. Williams?

X Q. 405. The plant that treats the tailings, slime tailings of the vanner?

A. On the other days which we haven't given in this tabulation, some days we run with large quantities of oil and some with small quantities, but we have not been able to get the larger quantities continually and we have had to go back to smaller quantities until we could get a sufficient supply.

X Q. 406. And all you have given is the selected examples of the use of large quantities of oil on different occasions?

A. Those which we thought would be most representative.

X Q. 407. Have you a full report of the operations for January? February, March and up to April 4, 1917, from which these selections have been made?

A. I am not certain if I have—I have at least a portion of them, Mr. Williams.

X Q. 408. You have produced a table showing the operations from March 21st to March 31st, 1917. That is right, is it not?

2496 A. Yes, sir.

X Q. 409. You have picked out in the list put in evidence, March 21st and March 27th. That is right, is it not?

A. Yes, sir.

X Q. 410. Why do you pick these particular days out rather than the others?

A. We were not running on large quantities of oil on all of the days.

X Q. 411. What was the smallest amount of oil that you used during these days from March 21st to March 30th?

A. .55 or fifty-five one hundredths of a pound per ton.

X Q. 412. But on March 21st, your record here is 1,440 tons of ore treated. Is that right?

A. March 21st we treated 135 tons in this particular run.

X Q. 413. But on that day, according to the report which you now show me, you treated 1,440 tons? Is that right?

A. Yes, sir. That test may have represented about eight hours or such a matter. I don't remember the details of this particular test.

X Q. 414. But this particular test occurring during this day's operation was selected for the purpose of this list? Is that right?

A. Yes, sir. Separate samples were taken and separate assays made, and so on.

X Q. 415. And then the figure of pounds of oil per ton for March 21st, is that the average of the whole day's operation?

2497 A. That is the average of the whole day's operation.

X Q. 416. So that it really shows nothing, in view of the great difference between the few hours which you used 25 pounds to the ton, and the rest of the time?

A. I don't understand what you mean by saying that it shows nothing. It shows the results of this day's operations.

X Q. 417. But it does not show what was the normal rate of oil per ton when you were using these large quantities?

A. No, this record would not show that.

X Q. 418. And have you the record which shows that?

A. I don't know that we have a comparison between those two. This represents the average result for the full 24 hours of March 21st, from that plant while that represents the short period during which that test was made, or whatever period it may be—I don't remember the duration. It was probably made on a few drums of oil that we got as a sample for trial.

X Q. 419. Then, on March 22nd you treated 1,680 tons and the oil was present in the amount of .64 pounds to the ton of ore, is that right?

A. The amount of initial oil used that day was .64 pounds per ton of oil.

X Q. 420. Now, on March 23d your average for the day appears to have gone up and you have no record of that in the selected list that you have given to us. Why is that?

2498 A. We did not endeavor to enumerate all of these different runs that we made.

X Q. 421. Was the run satisfactory—with reference to the particular run with the larger quantity of oil?

A. Well, fairly satisfactory, yes. It compared approximately with the results of the other plant which was operating on the old—or the small quantity method.

X Q. 422. But it was good—it wasn't good enough to put in the tables? Is that right?

A. I don't take it that way; it probably represented too small a tonnage.

X Q. 423. Then I see that on March 24th the amount of oil was .60 pounds per ton? Is that right?

A. Yes, sir; we used that quantity.

X Q. 424. And the next day .56? Right?

A. Yes, sir.

X Q. 425. And the next day .40?

A. Yes, sir.

X Q. 426. And the next day is March 27th which you have got in your selected list, and there the entire operations of the day were carried on with a large quantity of oil? Is that right?

A. Yes, sir; we made a full run, I believe, on that day and consequently this record will be identical with that.

X Q. 427. And then the next day I notice it goes to 9.93, is that right?

A. I believe that that other test ran on through part of the day there, but I am not certain, which probably accounts for that. We used it until the oil was gone and then went back to the small quantity method.

2499 X Q. 428. And so then probably that average for the day is increased by reason of the fact that this large quantity test ran over into that day? Is that right?

A. Very likely; I cannot recall the circumstances, but I think that is probably true.

X Q. 429. And on the next day you drop down to .55 pounds?

A. Yes, sir, and the recovery was 38.18, and the recovery on the day when we used 10 pounds, or 9.3 pounds, 32.33; and the recovery on the day when we used the .55, which was the smallest quantity, 32.47, so that the results there are very nearly parallel.

X Q. 430. Does this table show the oils that were used?

A. It shows the kinds of oil used but it does not show the relative proportions.

X Q. 431. What is this T. C. Sulphur?

A. That is an oil which we purchased over in California from the Tar & McCoomb Company.

X Q. 432. And it was called Sulphur Oil?

A. I think it was designated that way by the shippers.

X Q. 433. What kind of an oil is it?

A. It is a very viscous oil.

X Q. 434. And as to its general nature, aside from its viscosity, its origin or character?

A. It is California oil of some kind.

X Q. 435. Petroleum?

A. It comes from the California wells.

2500 X Q. 436. Some derivative of California petroleum?

A. I don't know whether it is a derivative or whether it is a crude oil. We have had so many of these oils that it is hard to keep track of them.

X Q. 437. Now, will you let me see the details of the operations of this slime vanner tailings flotation plant, at the period of the change in the other plant, commencing December 21st, 1916?

A. Do you wish to see the details of the operations of the vanner concentrating plant at the time that we made the change?

X Q. 438. No, of the tailings plant at the time you made the change in the concentrating plant.

A. That was November 18th, 19th and 20th. Shall I mark that for you?

(Witness marks the record.)

X Q. 439. Now turn on to December 20th and 21st.

A. There is nothing of importance you want to bring out here?

X Q. 440. No.

A. December 21st.

X Q. 441. From December 21st to December 31st on two days you used 1.07 pounds to the ton and the rest of the time it was less than one pound to the ton. Is that right?

A. On one day, the 25th.

X Q. 442. And the rest of the time it is less than one pound to a ton of ore. Is that right?

A. It appears so.

2501 X Q. 443. Now, give me the period in relation to January 7, 1917, in the slime vanner tailings plant.

A. January?

X Q. 444. January 7th particularly.

A. January 7th.

X Q. 445. How many tons of ore did you treat on that day?

A. In one plant we treated 1,372 tons, and in another plant 2,058 tons.

X Q. 446. The one that you selected for your special list was in the latter plant, is that right?

A. Yes, sir; I believe there was some special condition about that that made it necessary to take that figure, but just what, I cannot say at this time. The metallurgical results in the other plant were better.

X Q. 447. Where do you find in your detailed list, the oil percentages, the oil proportions that you have given in your special list, 9.72?

A. I don't find it here.

X Q. 448. Is that a mistake?

A. That would make it necessary for me to go back to the original record in order for me to determine that. But what I think is—I don't know the reason for that; I can't account for it.

X Q. 449. So far as you can see, the figure given there is erroneous and it should be 6.05 pounds to the ton, isn't that right?

A. There may be something in the previous—or in the report of that test that brought that quantity up to that. I don't know. These records are taken from supposedly the same record that this

2502 was taken from.

X Q. 450. Will you look that up and see whether you have made a mistake?

A. Yes, sir.

X Q. 451. And if you have made a mistake, correct it?

A. It was quite unintentional.

X Q. 452. In the plant which treats the vanner concentrates as operating commencing December 21st, 1916, what is the condition of the concentrates which you obtained as the finished concentrates, as to amount of oil? Have you any showing as to that?

A. We have no determination on the amount of oil contained in the concentrates. We, so far as I know, have never taken any samples of it.

X Q. 453. Do you make any effort to get rid of the large amount of oil you have there?

A. No, sir.

X Q. 454. Do you use over again any of the oil that you get in these concentrates?

A. Well, I presume there is some of the oil in the concentrates that gets back into the mill system from the water which is taken from the concentrates in the de-watering operation.

X Q. 455. That is to say, these concentrates go into what?

A. We take them first to settling tanks and then from settling tanks to filters.

X Q. 456. And in the settling tanks the mineral sinks and the water overflows. Is that right?

2503 A. Yes, sir.

X Q. 457. And the oil in excess would be apt to come to the surface would it not, and overflow with the water?

A. Well, I presume that some of the oil must go into solution in the water, probably, and quite likely goes out that way. I can't recall that I have ever seen any free oil actually floating on the water as it runs away from the tank, although such a thing might, although I never have noticed it.

X Q. 458. So far as your observation goes the insoluble oil sticks to the concentrates in this tank?

A. It appears to. At least I have never seen any free oil floating away.

X Q. 459. And then from the settling tank, where does the concentrate go?

A. To the filters.

X Q. 460. And the water that is obtained by that filtration is that used over again?

A. Yes, sir, that goes back in the circulating water system.

X Q. 461. What is the condition of that water, does it contain any insoluble oil?

A. I can't say whether it does or not. We have never had any analyses of it.

X Q. 462. You have no exact analyses?

A. No, sir.

X Q. 463. And that water goes back into the plant?

A. Yes, sir.

X Q. 464. Now, what you have said as to the flotation plant 2504 which treats the vanner concentrates, is or is not that true of the flotation plant which treats the vanner tailings?

A. Well, the concentrates from all the flotation plants are combined and settled and filtered together.

X Q. 465. Aside from what you have referred to as soluble oil, do you recover any oil in your operations from the concentrates?

A. We do not put the concentrates through any special process for de-oiling, or for removing the oil.

X Q. 466. From the point of the introduction of oil in either of the plants until the end of the plant, is there any process for taking out and making use of the oil—for taking out the oil from the plant? Does it stay absolutely in the plant and in the pulp from beginning to the end—aside, of course, from what you call the returning of the middlings?

A. Except for the circulating load, there is no effort to remove the oil or dispose of the excess or in any way segregate it from the ore or from the pulp.

X Q. 467. That is to say the oil that is found in there has to be taken care of in the plant as you have described it. There is no other way to get it out or get it back or save it, or use it over again than what you have described; is that right?

A. No, sir.

X Q. 468. Yes, sir, it is right?

A. There is no other way—that is, there is no way of segregating the oil from the pulp after it is once added except what the water will take out, and of course the circulating load, which you except.

2505 X Q. 469. You can not tell me how much of the original oil is in the concentrates by any figure or determination that you had at any time made?

A. I don't recall that any such analysis has been made.

X Q. 470. Take, for instance, before December 21st, was any such analysis made at any time?

A. Not within the limits of my recollection, there was no such analysis made.

X Q. 471. And since, commencing December 21st, no analysis?

A. We have made a number. We have taken a number of samples and made a number of determinations to sort of give us practice in oil determination and so on, but we haven't made any systematic determination or systematic sampling, and systematic determination such as you would in ordinary metallurgical results.

X Q. 472. Have you any records of those determinations?

A. I have none here, I think; I didn't bring them with me. I might have something, and I will see. (Witness refers to his papers.) No, sir, I have nothing here.

X Q. 473. Can you give any record of these determinations and give information in regard to them?

A. If any record was made of them I can get them. They were somewhat in the nature of practice for the chemist and I don't know whether they made records of it or not.

2506 X Q. 474. Do you happen to know how they made the oil determination?

A. No, I don't except I know we experimented with the Soxhlet apparatus, and we made a number of determinations with extraction

by ether, by beakers, and then treating the material and so on, that is, decanting the liquor and evaporating the ether.

X Q. 475. I notice that in your list, defendant's exhibit 28, of the operations in the slime vanner tailings plant you had a heading "Other reagents, pounds per ton," and blank, nothing shown under here. Does that mean that in this plant you never used any other reagents than what you have called oils?

A. I don't believe we have ever used any other reagents in sufficient quantity to represent anything that might be recorded there. We have conducted a number of experiments with different reagents but never anything commercial nor anything of importance.

X Q. 476. I notice that in your list, defendant's exhibit 28, of the operations of the slime vanner tailings plant, you have a heading "other reagents, pounds per ton," and blanks down under that heading, nothing showing. What is the meaning of that, and what other reagents have you used in your plant other than what you have called oils?

A. I don't know that we have ever used any other reagents in sufficient quantity to represent anything that might be recorded there. We have conducted a number of experiments with different
2507 reagents, but never anything commercial, or never anything of importance.

X Q. 477. That is to say, from time to time you have experimented with other reagents, and never made a record of it?

A. The record probably exists, but it was in such minute quantity that in summing up those it was not any more than a bare fraction of a pound.

X Q. 478. Now in the table showing the flotation operations on the retreatment of vanner concentrates, I see that your heading "other reagents, pounds per ton," is in every instance accompanied by some figures. That is right, isn't it?

A. Yes.

X Q. 479. Now, what are those other reagents?

A. We used a number of them; I don't know that I can describe them.

X Q. 480. Have you a record of them?

A. I haven't any record of them here.

X Q. 481. You could get a record of them?

A. I don't know that I have authority to produce them, but I could get them.

X Q. 482. What is your general recollection—your best recollection as to the other reagents that have been used?

A. We have used sodium compounds and calcium compounds.

X Q. 483. What sodium compounds have you used?

A. We have used sodium carbonate and sodium sulphide and caustic soda, which is soda hydroxide.

2508 X Q. 484. What calcium compounds have you used?

A. Calcium carbonate, and we have endeavored to use calcium sulphate.

X Q. 485. What was the purpose of using these other reagents?

A. To improve the metallurgical results of the operation.

X Q. 486. To improve the metallurgical results of the flotation operation?

A. Yes, sir.

X Q. 487. Your list gives under the heading "other reagents, pounds per ton," amount varying from .130 to 6.520 pounds per ton. I will ask you to supply information as to what reagents are described in these figures that you have given in the table that you have produced? Will you make your best effort to obtain that information?

A. I can obtain the information, but with reference to producing it, I would have to obtain permission, of course.

X Q. 488. Will you endeavor to obtain that permission?

A. I will ask for it.

X Q. 489. I will ask you later. Have you made any determinations or have you any information as to the oil going out with the tailings that flow out of the flotation plants?

A. No, we have no determinations of that.

X Q. 490. Has your observation been that any insoluble oil goes out with the tailings?

2509 A. I have never seen any—just what do you mean by insoluble oil?

X Q. 491. Undissolved oil?

A. Well, that would be apparent on the surface?

X Q. 492. It might be detected on the surface or it might show as an emulsification in the mass?

A. I don't recall that I have ever seen any free oil going out in the tailings stream.

X Q. 493. The water of the tailings does not go to waste, does it?

A. No, it goes out in the tailings stream leaving the mill, and then goes to the tailings dam and is there impounded.

X Q. 494. So that water goes back again through the mill?

A. Yes. We always see a limited amount of froth on the tailings stream; we have always seen that, even before we had flotation.

X Q. 495. That is to say at the dam?

A. No, in the tail race, or the tailings launder leading to the dam.

X Q. 496. But no free oil as far as you know?

A. As far as I know I never have seen any free oil.

X Q. 497. As a matter of fact you don't know where all this oil goes to, do you?

A. That is not our object, to find out where it goes to, but to get metallurgical results and make money.

X Q. 498. But you do know where all this oil goes?

2510 A. I don't know.

X Q. 499. How much do you use per day in your largest oil operations?

A. Well, I can easily figure it, but I don't suppose that it would amount to over two tank cars a day.

X Q. 500. That would be how many pounds of oil?

A. About 200,000 pounds or such a matter.

X Q. 501. 200,000 pounds of oil a day?

A. Or possibly a little more.

X Q. 502. Do you buy that much oil and use that much oil for those days?

A. We have not been able to get it yet, but we will do so as soon as we get it lined up.

X Q. 503. Now, take a day when you used 209,000 pounds of oil?

A. I said we would use that quantity, using it at the rate that we do use it.

X Q. 504. Well, that would be true if you were using both your plants; is that your computation—using a large quantity of oil in both your plants, or as you are now doing?

A. Well, I had reference to the tailings plant then, of course. The flotation cleaning plant is operating steadily, because we have oil for that.

X Q. 505. The vanner concentrates plant, that is operating steadily with large quantities of oil?

A. Yes.

X Q. 506. How much oil are you using per day in that?

2511 A. I can easily figure it from the quantity shown there. For what particular period do you wish?

X Q. 507. Well, take a maximum day, a maximum oil proportion?

A. It is difficult to pick out a maximum day, because there are great fluctuations in the tonnage treated, as well as in the quantities of oil required.

X Q. 508. Take the month of March. The average for that month, as you have given it is 23.73 pounds of initial oil per ton of ore?

A. Yes.

X Q. 509. Now, take the maximum day in the month of March?

A. I haven't the record for the month of March, because that was not completed when I left Hurley.

X Q. 510. Well, take the maximum that you have?

A. I have in February 23 pounds per ton.

X Q. 511. Well, here is 23.5?

A. Here is one 23.89.

X Q. 512. Take 23.89 per ton, and tell me how many tons of oil you fed into that plant on that day?

A. We treated 265 tons, and we fed at the rate of 23.89 pounds per ton. It is a matter of computation. I think I have figured it right. 6330.85 pounds of oil were fed to the plant on that day, in 24 hours.

Mr. Scott:

X Q. 513. Please state the date and the amount of oil so that the record will be clear?

A. This quantity of oil was used on the 25th of February. The tonnage treated was 265 tons, and we used 23.89 pounds of oil per ton, making 6330.85 pounds in 24 hours.

2512 X Q. 514. Now, that oil, so far as you know, all went to the concentrates, didn't it?

A. I don't know where it went. It did not particularly concern us, as long as it took that amount of oil to produce the result.

X Q. 515. What was the weight of the concentrates on that day?

A. 85 tons.

X Q. 516. And after those concentrates had gone through the filter, what became of them?

A. The concentrates stay on the outside of the filter you know.

X Q. 517. Well, had gone through the filter treatment. I suppose you refer to the Oliver filter?

A. Yes, the Oliver type; the Portland filter. The concentrates from the filter go to the concentrate bins, and there are loaded out occasionally or conveniently into cars, and from those cars they are taken to the smelter.

X Q. 518. That is, does your concern sell its concentrates to the smelter?

A. I have no knowledge of the business end of the company, but I have generally understood that they sell their concentrates to the smelter. Just what the agreement is by which they dispose of them I don't know.

X Q. 519. Have you had any trouble because of the amount of oil in the concentrates?

A. I have heard of none, no, sir.

X Q. 520. But you would hear about that?

2513 A. I might hear of it and I might not. They might mention it to me, and they might not.

Whereupon an adjournment was taken until Thursday morning, April 19, 1917, 10:00 a. m.

Thursday, April 19, 1917—10:00 a. m.

Trial resumed pursuant to adjournment, all parties present; whereupon the following proceedings were had:

Mr. Wicks resumed the stand for further cross-examination (Resumed).

By Mr. Williams:

X Q. 527. In answering Q. 45 yesterday, you were asked whether any other oil was used besides the Barrett and the Jones, and you replied that you used a little pine tar and other things, and then in Q. 47 Mr. Scott asked you, "Did you operate at any time without the pine oil," thus changing pine tar to pine oil, probably unintentionally. You answered affirmatively, and in Q. 49 you were asked "Is this use of pine oil exceptional or general?" And you answered "It is rather exceptional." Did you intend to say pine tar throughout those questions and answers, or was pine tar a mistake, corrected by counsel?

2514 A. Pine oil, as I generally consider it in my mind, includes all classes of pine oil, steam distilled, destructively distilled, and pine tar oils, and of course there are others too. In this record to which you referred I think where we mentioned pine tar that was pine tar oil, and I think that that was what was under

discussion when I was talking to Mr. Scott. As far as I remember that was parallel. We do use occasionally, however, destructively distilled pine oil, which is not considered strictly a pine tar oil, but the use of any of them is rather exceptional.

X Q. 528. Do you use a steam distilled pine oil?

A. We have not used any steam distilled pine oil for some time.

X Q. 529. But you have used it?

A. Yes, I think it was used in actual operation some time ago.

X Q. 530. Is it any more expensive than the destructively distilled pine oil?

A. I don't know what the comparison is, but I believe that steam distilled pine oil is generally considered a somewhat higher priced product than the destructively distilled.

X Q. 531. And pine tar is quite a different thing, is it not?

A. It is a somewhat more viscous oil from the distillation of pine woods.

X Q. 532. Now, between the vanners and the commencement of the vanner concentrates flotation plant, you have a classifier as I understand from your testimony?

2515 A. Yes, sir.

X Q. 533. What kind of classifier?

A. A hydraulic classifier.

X Q. 534. Is there anything else between the vanners and the flotation plant?

A. Well, we have to thicken the classifier products to a certain extent to bring them down to approximately the right consistency for flotation treatment.

X Q. 535. Then you have a dewatering arrangement?

A. A set of thickening tanks, to take off the excess water.

X Q. 536. And in these thickening tanks there is an overflow of the excess water?

A. Yes.

X Q. 537. That is the way you get rid of it?

A. That goes back into the mill, in circulation.

X Q. 538. Now, that is all that there is, then, between the vanners and the flotation plant, the classifier and the thickener?

A. Well, of course there are pumps or elevators or whatever may be required to overcome differences in elevation.

X Q. 539. Well, in this particular plant that you have described, for treating vanner concentrates——

A. Sometimes we operate pumps for that, and sometimes elevators and sometimes both of them together, to convey the concentrates from the vanners back to the classifiers.

X Q. 540. Pumps to convey the vanner concentrates to the classifiers?

2516 A. From the vanner to the classifiers; yes, sir.

X Q. 541. Then from the classifier to the thickeners?

A. From the classifiers to the thickeners the material now flows by gravity.

X Q. 542. And from the thickeners to the flotation plant?

A. Also by gravity.

X Q. 543. In the first place, where, in that series of operations, is the oil added?

A. That is—after the material leaves the thickening tank it passes into a little storage tank or a little regulating tank just ahead of the flotation machines, and then the oil is added as the material leaves this little storage tank.

X Q. 544. As it leaves that tank?

A. Yes, sir.

X Q. 545. So that it is added in the pipes that flow from this tank to the flotation plant; is that right?

A. In the launders.

X Q. 546. In the launders?

A. Yes, sir.

X Q. 547. And no other oil is added to the pulp before it reaches these launders?

A. No.

X Q. 548. Now, those launders go directly to the flotation plant?

A. They go right into the flotation machine, that is into the first emulsifier of the flotation apparatus.

X Q. 549. Is there any overflow of water between the point where the oil commences to enter the pulp and the point where the
2517 pulp enters the first emulsifier?

A. No, sir; there is not.

X Q. 550. So that every drop of oil that gets into the pulp goes into the flotation plant?

A. So far as I know every drop of oil that is added to the feed in these launders goes into the flotation machines; yes, sir.

X Q. 551. About how long are these launders?

A. I think that it is probably about six or eight feet between the feed tank and the emulsifier.

X Q. 552. Does the pulp flow through the emulsifiers in series?

A. It passes through three emulsifiers in series; yes, sir.

X Q. 553. One after the other?

A. Yes, sir.

X Q. 554. There is the same speed of rotation in the emulsifier, in the agitating blades, as in the other parts of the plant?

A. Yes, sir.

X Q. 555. Then from the emulsifiers it passes how to the first rougher machine?

A. It is fed directly into the machine and the machine throws it out into the spitzkasten.

X Q. 556. Of course your determination of pounds of oil per ton of solids in the feed or per ton of ore, is made by taking samples of the feed and determining the amount of oil in them and determining the rate of feed? Is that right?

2518 A. Yes, sir, we take periodical samples of the feed as it leaves these feed tanks of which I spoke, and that sample is taken for determination for the tonnage and the pounds of the pulp.

X Q. 557. Now you take the tailings from the cleaner machine and carry that back to the head of the rougher machines, do you not?

A. You are evidently confusing in your mind between the two plants, Mr. Williams. We were discussing the vanner concentrate cleaning plant, were we not?

X Q. 558. No, no; I am talking now of the flotation plant; I have left the vanner plant.

A. That is the flotation plant which treats the vanner concentrates?

X Q. 559. Yes. Now, in the flotation plant that treats the vanner concentrates what becomes of the tailings from the cleaner machines?

A. In that plant, Mr. Williams, we do not operate a separate set of roughers and cleaners as we do in the plant that treats the vanner tailings and which I explained yesterday. The apparatus is somewhat different in the plant treating the vanner concentrates.

X Q. 560. I don't believe that you have described that separately.

A. I don't think that I was given an opportunity to do so yesterday, Mr. Williams.

X Q. 561. You may do so.

A. The plant which treats the vanner concentrates receives the feed, as I have described it, and from this feed tank. The
2519 feed passes through three emulsifiers and then to the first flotation machine. Then it passes through from one flotation machine to another, down through a series of 14 cells and of course a froth is taken off of each spitzkasten belonging to each of the 14 cells. The first few spitzkastens produce a high grade, finished concentrate. The remainder of the spitzkastens, then, they produce a lower grade concentrate which constitutes the circulating load in that plant, and that is returned as a middling back into the first emulsifier by means of an elevator and joins the initial feed. Then the tailings from this plant are sufficiently low to be wasted.

X Q. 562. You have not given us any determination of the amount of oil that was carried around in this lower grade of concentrates which go back to the head of the emulsifier.

A. I don't know the exact quantity of oil there. I know that some determinations were taken but I never considered the method very accurate. They may have been accurate but they have not been proven to be yet, so that we did not consider them sufficiently important to bring them. However, there is a large quantity of circulating oil.

X Q. 563. And also a large quantity of circulating material?

A. Yes, sir.

X Q. 564. Now, as to the vanner tailing plant, there you have cleaner cells and the cleaner machines and the rougher machines, and there you take the tailings from the cleaner machines
2520 and bring them back to what point?

A. Either ahead of the emulsifier or follow the emulsifier, but in either case they join the initial feed ahead of the first flotation machine.

X Q. 565. And that carries a great amount of solid material?

A. That carries some, but the solid material—the tonnage of

solid material isn't so very great there. The volume of pulp is very considerable but it is very dilute.

X Q. 566. What determination have you made of the amount of solid material which is thus carried along and fed into the roughers?

A. I don't know that I have this record but I will investigate. I have one sample taken on April 4th in which the cleaner tailings or the circulating load contained, in one case, 6.5% solids, and in another case 6% solids, these two samples being taken on April 4th; and I can't say the period of time over which they covered, but I think that that represented a 24-hour run. April 4th, 1917.

X Q. 567. Now, have you any determination of the proportion of oil to solids in that circulating load?

A. In that circulating load the total volume of the pulp contained .06 and .07 per cent oil. That percentage is based on the total weight—I said volume, but I meant the total weight of the water and solids together.

X Q. 568. That gives all the items does it not?

2521 A. I think that one would be able to compute the remainder of the figures from that.

X Q 569. Now, if in fact the amount of solids carried around from the end of the cleaner machines back to the head of the rougher machines was one third the amount of the solids fed into the rougher machines from the vanners, and if then the proportion of oil in weight that you have given it was one third of the proportion of oil in the original feed, then you would have the condition that the proportion of oil to solids in the rougher machines would be absolutely unaltered by the circulating load?

A. That is true, Mr. Williams. We always take that tonnage of the circulating load into consideration in computing our figures of the total pounds of oil present in the machine, that is, we base it not only on the initial tonnage, but also on the tonnage circulated.

X Q. 570. But those are not the figures you have given here?

A. They were intended to be.

X Q. 571. Because you have given the feed to the flotation plant from the vanners. That would be the only proper estimate of the amount of material treated?

A. Pardon me; to which statement did you refer there?

X Q. 572. The slime vanner tailings?

A. We have only given one absolute figure of pounds of oil in the circulating load.

X Q. 573. Yes.

A. And in that one we show 3.2 pounds of oil in the
2522 circulating load per ton of initial feed. I think if those figures are computed back, you will find that due allowance was made for the tonnage of material circulated. It is quite a long calculation, however.

X Q. 574. But your weight in dry tons of flotation headings is 3,250?

A. Yes.

X Q. 575. Your initial oil in pounds per ton is 8.10 pounds per ton of flotation headings?

A. Yes.

X Q. 576. You have said that the amount of oil in the circulating load is at the rate of 3.2 pounds per ton of flotation headings?

A. Of initial feed, yes; based on 3,250 tons.

X Q. 577. Then you give a total oil pounds per ton as 11.3, but you do not anywhere give the amount of solid material that is carried back and put into the rougher in connection with that oil. That is right, isn't it?

A. I have just given you those figures in reading from this other statement, by which you can compute that.

X Q. 578. But you did not give them in your tables?

A. It was not considered necessary. It could be given, and I believe that I have—at least it was intended that that should include that circulating tonnage of material just the same as we include the circulating oil.

X Q. 579. How long would it take you to satisfy yourself that your figures here are based upon the actual amount of material that was going through those rougher machines?

2523 A. I can make a computation of that and have it ready for you later, if you wish?

X Q. 580. I will ask you to do so?

A. Very well.

X Q. 581. Now, how many tons of pulp was returned on that particular day and in that particular operation from the cleaner to the rougher machines?

A. In one case there were 3,888 wet tons of circulating load, combining water and solids, or liquids and solids.

X Q. 582. On April 4th, 1917?

A. Yes, there was in one case, and in another case, 4,165 wet tons.

X Q. 583. Those are all of your measurements?

A. Yes.

X Q. 584. Now you have not given a description of the apparatus between the vanner slime tailings and the flotation machine which treats those tailings. Just tell me what that apparatus is?

A. There is none at all—that is, during the greater part of this time. Just at the present time we are sending a little of our exceedingly fine slimes directly from the upper classifiers to settling tanks and then to flotation, which has the effect of bypassing the vanners, but other than that there is no cleaning or preliminary handling or anything between the vanners and the flotation plant.

X Q. 585. Any classifying?

A. None.

X Q. 586. All the tailings of the vanners flow directly into the flotation machine?

2524 A. As I said yesterday, there is a certain tonnage of vanner tailings that are now too coarse to be treated by flotation, and we are not treating them, because they are too coarse, and because we have not flotation capacity for them.

X Q. 587. And you are not classifying so as to separate the fine material?

A. Well, they are treated at separate vanners anyway, so the separation takes place before the vanner treatment.

X Q. 588. And in this slimes flotation plant, what is the exact point of the addition of the oil?

A. Just as the material passes into the emulsifier. Of course sometimes we have found that the oil was not necessary ahead of the emulsifiers, so that the emulsifiers are cut out.

X Q. 589. Yes, you said that before. Now, I called your attention to what appeared to be an error in your table, yesterday, by comparing it with the original reports?

A. Yes.

X Q. 590. Have you a correction to make?

A. In investigating that, I satisfied myself that the statement as submitted to the court is correct. The error was one on this other sheet, which was entirely clerical. That was on January 7th. I will call attention to the fact that in making up this statement the clerk divided the oil equally between the two plants, plant No. 1 and plant No. 4, in each case. This is ordinarily satisfactory for
2525 our daily operation, and in this particular test the statistician in the office was not familiar with the situation, and he divided the total amount of oil equally between the two plants there, which made it six and a half pounds, based on the whole tonnage treated in the two plants, but the correct figure is 9.72 pounds on the 7th for the plant in which the test was operated, and 1.70 pounds in the plant in which the test was not made.

X Q. 591. That is to say, the test was made in one plant, and in these figures the oil was averaged up between the two?

A. Yes, sir.

X Q. 592. Then there is another matter that I want you to verify. The total for the fourth quarter of 1915, weight, dry tons of flotation concentrates, is given as 20,842. My calculators tell me that that is a mistake; that the other figures require it to be about 2,084, a difference of some 19,000 tons. Will you verify that?

A. I believe they are wrong, Mr. Williams. I will be glad to check that over sometime if you wish.

X Q. 593. Will you check that over and tell me later whether or not you are right? There may be some other error that explains it. Just go over that calculation, please?

A. Yes, I will. You don't wish me to calculate that now, do you?

X Q. 594. No. Now, in this table of flotation operations of slime vanner tailings you have a heading "flotation concentrates," and "weight, dry tons"; is that the weight of the concentrates dry?
2526 A. How do you mean, Mr. Williams?

X Q. 595. Is that the weight of the concentrates alone, or does it include the weight of any liquid oil that may be with them?

A. Well, that would be hard to answer.

X Q. 596. It is given as dry weight. Now are the concentrates dried, or are they loaded with the oil?

A. Well, I am not able to say how much oil might remain in them and how much might be volatilized in the drying operation.

X Q. 597. You don't know?

A. No, sir; I have no means of telling that.

X Q. 598. What is the drying operation that you speak of?

A. That is in drying your samples down for assay and analysis and so on.

X Q. 599. Not what occurs in the machine itself; that is to say, not the filtration.

A. Well, these dry weights, of course, must be computed from the total amount of flotation concentrates shipped, and those of course must check back with the theoretical amounts from day to day within reasonable limits of accuracy, and all of the dry weights are figured by taking moisture samples of the material loaded in the cars as they are shipped, and then those samples are taken down to the laboratory and dried on a steam plate or in a steam oven, and then the loss in weight in the drying operations is considered the moisture.

X Q. 600. So that when the samples are taken and have
2527 been absolutely dried, all the oil has been either driven off or made into a solid?

A. I don't see how the oil has anything to do with it.

X Q. 601. You don't know what has become of the oil; that is the fact, isn't it?

A. I don't know whether it has volatilized or not, no, sir, and the percentage would be very small anyway.

X Q. 602. I notice down in your other list you do not give us the dry weight of the flotation concentrates at all; that column is blank?

A. We had no means of segregating those figures there; that can easily be computed back, but as we have not the actual figures, we did not show them.

X Q. 603. Those figures, if they were computed, might tell us something about the reason for the large quantities of oil, might they not?

A. They can easily be furnished, but it was a physical impossibility to get accurate samples at the time the runs were made.

X Q. 604. Why?

A. Because it is impossible to segregate this particular concentrate from the remainder of the tonnage being shipped at that time. It would be possible to do so if the equipment at the plant permitted it, but under the present conditions it does not permit it.

X Q. 605. You mix that up with other concentrates, is that right?

A. Yes.

2528 X Q. 606. So you have not any reliable figures there?

A. No, sir. We could have taken dilution samples, probably, and arrived at approximate figures, or we can calculate that, if you wish.

X Q. 607. Now, I asked you yesterday to compute the total amount of oil fed to the vanner concentrates plant on a day when the tonnage treated was 265 tons, and you used 23.89 pounds of oil per ton, and then I asked you what was the weight of the concentrates on that day and you gave me the weight 85 tons. Now, I thought you gave me the weight of the concentrates of the plant that we were talking about. Did you?

A. I did.

X Q. 608. And 85 tons of concentrates were produced on that day from that particular plant, is that right?

A. Yes.

X Q. 609. From those 265 tons of feed?

A. Yes, I believe that to be reasonably accurate.

X Q. 610. Why do you say "I believe that to be reasonably accurate?"

A. Well, I did not make the measurements myself.

X Q. 611. You don't think the method of measurement was accurate, is that the idea?

A. No, I did not mean to infer that at all; I meant that I did not have any direct personal knowledge of it, because I did not take the measurements myself; I had to depend on the boys who operate the plant and take these measurements, to compile these figures for me.

2529 X Q. 612. I suppose that is true of a good many of the figures is it?

A. Well, naturally I cannot compile all the figures myself.

X Q. 613. So that you cannot say of your own knowledge as to a good many of those figures, that they are accurate?

A. I can say that I have absolutely every reason to believe that they are accurate, because I have confidence in my organization.

X Q. 614. But the work has been done by your subordinates?

A. Necessarily so.

X Q. 615. Now, these recoveries that show in these figures they are the result of computation, are they not?

A. Yes, in that case they are.

X Q. 616. And what is the method of computation?

A. I don't recall the formula right now that they use for that. It is that formula, I believe, developed by Dr. Gahl; I think it is the weight of the concentrates times the difference between the assay at the heads and the assay of the tailings, and that product divided by the assay of the heads multiplied by the difference between the assay of the concentrates and the assay of the tailings. That is the standard formula I believe, used in all places.

Mr. Williams: For the present, if your honor please, I have proceeded as far as possible in the cross examination of this witness.

2530 Redirect examination.

By Mr. Scott:

R. Q. 617. Mr. Wicks, referring to the vanner concentrate table, under defendant's exhibit 26, will you state whether on each and every day of the period between December 21, 1916, and March 31, 1917, the amount of oil used was in excess of 20 pounds per ton? I see we have averages here, and the question is directed to whether each and every day went above 20 pounds.

A. Every day with the exception of one day. I can verify that in a minute—every day except one, 26th of December, when, for some reason they dropped down to 18.18 pounds per ton.

R. Q. 618. Is it an easy matter to feed the oil so that you get a certain predetermined amount per ton?

A. No, sir. It is very difficult to do that. The tonnage varies considerable and the rate at which the oil will flow out of a given aperture varies considerable and the smaller the aperture the greater likelihood of fluctuation, so that it is rather difficult to maintain exact tonnages. They maintain the amount of oil more by the appearance of the plant than by the actual volume of oil going in at any one time.

R. Q. 619. Now, referring to the slime vanner tailings tabulation, defendant's exhibit 28, and to the part of the tabulation relating to the experiments between January 7th and April 4, 1917, I notice in some instances the tonnage treated in the experiment runs into
2531 the thousands and others into the hundreds only. Were these experiments carried out in different plants or parts of the same plant?

A. They were all conducted in full scale machines, that is, ordinary operating machines, but in three cases there where the tonnage is relatively small we operated only two rows out of eight rows, or one quarter of the total plant.

R. Q. 620. That was March 13th, 14th and 21st?

A. March 13th and March 21st. The reason for that was that the quantity of oil available for the run was not great enough to make it possible to get a good length of run on the full scale.

R. Q. 621. Before leaving the plant at Hurley to come to Butte, did you come to any decision as to the future mode of operating the plant upon slime vanner tailings as a result of the experiments between January 7, and April 4?

A. Well, the results were all submitted to Mr. Sulley, the manager, and I presume it was on the basis of these results that he issued certain instructions with reference to future operations.

R. Q. 622. And what were these instructions?

Mr. Garrison: I object; how can that be relevant, if your honor please.

The Court: I think the past operations will serve the purposes of this case. The objection will be sustained.

Witness excused.

2532 OBA WISER, a witness called on behalf of the defendant, having been first duly sworn, testified as follows:

Direct examination.

By Mr. Scott:

Q. 1. What is your full name?

A. Oba Wiser.

Q. 2. What is your occupation?

A. At the present time I have the position of metallurgist for the Chino Copper Company.

Q. 3. Are you associated with Mr. Wicks in your duties?

A. Yes, sir.

Q. 4. You have heard Mr. Wicks' testimony today and yesterday?

A. Yes, sir.

Q. 5. During what period, Mr. Wiser, have you been employed as metallurgist at the Hurley plant of the Chino Copper Company?

A. Since June, 1914.

Q. 6. Are you conversant with the flotation operations which are tabulated upon this sheet, "Detailed Record of Flotation Operations on the Retreatment of Vanner Concentrates", this being defendant's exhibit 26?

A. Yes, sir; I was there when the operations were conducted.

Q. 7. Throughout the period from December 8th, 1914, to date?

2533 A. Well, with the exception of probably two weeks' vacation in 1915 and two weeks' in 1916, I think it was away from the plant.

Q. 8. You were there during the first half of 1916, were you, and December, 1914?

A. Yes, I did not leave the plant until along in September, 1915.

Q. 9. Do you know whether the figures and results set forth here are accurately stated?

A. I think they are reasonably accurate.

Q. 10. Well, by "reasonably"—within what limits do you mean?

A. Well, insofar as it is possible for——

Q. 11. (Interrupting.) You mean that they are as accurate as it is possible to make them; is that what you mean?

A. Well, I would say that, yes.

Q. 12. This is the exhibit from which we struck three or four lines on account of Mr. Wicks not having been connected with the plant during the first part of 1915, and if counsel has no objection I would like to substitute this inasmuch as Mr. Weiser has testified to the accuracy of this first part.

Mr. Garrison: I intend to interpose an objection based on the same ground as interposed with respect to the testimony of Mr. Wicks, as to the competency and relevancy of the testimony to be given by this witness. Personally, I have no objection if Mr. Williams thinks of none, for the course to be pursued by Mr. Scott with respect to that exhibit if your honor accepts it, but I desire

2534 to have the objection recorded before your honor rules upon the method of introducing the proof. After the objection is ruled on——

Mr. Kremer: I am going to suggest, in view of the fact that there will be a number of witnesses of this same character, it might be considered that the objection is interposed instead of constant repetition of it.

The Court: Was there an objection to this originally?

Mr. Garrison: I don't know whether there was an objection specifically to this sheet. I gather that your honor had——

The Court: You object to all of this variety of testimony?

Mr. Garrison: Yes, sir, and I thought that it was not necessary to encumber the record by constant repetition, and object to the details unless the detail was objectionable.

The Court: The court must have overruled it then.

Mr. Garrison: I imagine so.

The Court: I will overrule it now.

Mr. Garrison: Your honor at this time understands the same as I, when I once object to the whole line of testimony from a witness, there is no necessity to renew it.

The Court: No, it will cover all of that.

Mr. Garrison: That is, if we had a specific objection it would cover that. My previous objection does not go to the offer of
2535 Mr. Scott based upon this witness. I have no objection to substituting one sheet for the other. With that understanding, Mr. Wicks' testimony only goes to so much of the sheet as is contained after the date of his employment, and that this gentleman's testimony goes to the portion before that, we have no objection to the sheet being put in, with the understanding that it is divided as to these dates.

The Court: Leave the old one in and put a new one in.

Examination on voir dire.

By Mr. Garrison:

Q. 13. Now, Mr. Wiser, do your duties enjoin upon you to have knowledge with respect to the various matters that are set forth upon that sheet?

A. Yes, sir.

Q. 14. And have you such knowledge of your own, derived from attendance at the mill, that enables you to say that so far as you know, the various figures on this sheet are accurate and correct representations of actions which took place?

A. Yes, sir.

Q. 15. Of your own personal knowledge?

A. Yes, sir, of my own personal knowledge.

Q. 16. So that if we should cross-examine you with respect to this you would not be in a position of saying that "as to that, I don't know that; that is something somebody else knows"?

A. Yes, sir.

2536 Q. 17. You will be able to answer the questions?

A. I think so.

Mr. Garrison: We have no objection then, on the matter of form.

Mr. Kremer: We offer it and ask that it be marked the next number.

The sheet was admitted in evidence and marked Defendant's Exhibit 29.

Direct examination continued.

By Mr. Scott:

Q. 18. Mr. Wiser, will you explain the items of this table down to the second quarter of 1915; just explain what the items mean, the first column entitled "Flotation Heading," with three subheads under.

A. Take these up just as they appear on the sheet, Mr. Scott?

Q. 19. Yes, please.

A. December 8 to 31 represents the period when we began the retreatment of vanner concentrate.

Q. 20. Two thousand three, the first item there, is the total?

A. Two thousand three tons were treated during that period, an average daily tonnage of 105. Per cent copper in the headings, 13.19; flotation concentrates produced, 588; per cent copper, 42.87——

The Court: What is the witness doing? Simply reading off this table that has already been introduced?

Mr. Kremer: Supplements by a statement of the operations.

2537 The Court: I don't see any necessity of reading this off in detail. They are in evidence. If a question is to be based on it, proceed.

Q. 21. Were you in daily charge of these flotation operations?

A. Yes, sir.

Q. 22. And the operations set forth upon this sheet were carried out under your supervision?

A. Yes, sir.

Q. 23. I hand you defendant's exhibit 28. That is the tabulated statement of the treatment of slime vanner tailings, and ask you if you were present and directly in supervision of the operations there represented throughout the period stated?

A. With the exception of the two vacations I mentio .

Q. 24. Your connection and supervision covered the period beginning with April 16, 1915?

A. Yes.

Mr. Scott: That was an item that was not proved by Mr. Wicks.

Examination on voir dire.

By Mr. Garrison:

Q. 25. Now, Mr. Wiser, your personal knowledge with respect to these entries appearing on defendant's exhibit 28, is such that you can personally answer questions with respect to the verity of these figures; is that correct?

A. Yes, sir.

2538 Cross-examination.

By Mr. Williams:

X Q. 26. I note that this last sheet now marked defendant's exhibit 28, that it contains your signature; how does it happen that exhibit 28 is signed by you, and exhibit 29 is signed by Mr. Wicks?

A. Mr. Wicks, I believe, had that report prepared and therefore signed it. This report I prepared myself or had prepared and I think I signed this after Mr. Wicks had left our plant.

X Q. 27. So that the report signed by you was prepared by you?

A. Well, I had supervision of the preparation of it.

X Q. 28. Whose business is it, or whose duty is it, in the ordinary course of business, to sign reports of this kind?

A. Well, there never has been any definite understanding as to who signs these reports. Both the metallurgical engineer and the assistant superintendent sign reports of the same character.

X Q. 29. When did the Chino Copper Company commence to treat slime vanner tailings in their regular operations?

A. In their regular operations, the first slime vanner tailings we treated was the treatment began on April 16, 1915. I will say that for the first three or four months the operations were more of an experimental nature than they were regular operations.

X Q. 30. Did the plant run continuously?

2539 A. Well, it was running continuously for the date set forth in that summary. The other days——

X Q. 31. (Interrupting.) The interims are just shutdowns for alterations, I suppose?

A. For alterations.

X Q. 32. So that this report covers the whole period of the treatment of slime vanner tailings in the Chino plant?

A. Yes, sir, it covers all operations for that product.

X Q. 33. And that is equally true as to the other report, exhibit 29, which commences December 8, 1914; that covers all the treatment—retreatments of that product, vanner concentrate, in the Chino plant?

A. Yes, sir; it covers everything.

X Q. 34. When you started in December 8th, 1914, what machines did you have; what flotation machines?

A. We had the Janney flotation machine.

X Q. 35. Same general type of machine or same machines that you have now?

A. About the same thing that we have now.

X Q. 36. Of course these original machines did not have any porous medium covered chambers for the introduction of air, did they?

A. You are referring now to the machine we use in the retreatment of concentrates are you not?

X Q. 37. I am referring to the machine that has been called the Janney Mechanical Air Machine.

A. In the retreatment plant we are using the Janney Mechanical machine exclusively.

X Q. 38. That is, retreating what?

2540 A. Vanner concentrates.

X Q. 39. It is only in the slime vanner tailings plant that you use these machines that have the air supplement? Is that right?

A. Yes, sir.

X Q. 40. So these Janney machines installed December 8, 1914, were substantially the same as the machines that Mr. Wicks has described?

A. Substantially the same, having a Spitzkasten on one side only.

X Q. 41. Then on April 16, 1915, when you started to treat the slime vanner tailings, what machines did you install?

A. That was the mechanical.

X Q. 42. Just the mechanical machine?

A. With the double Spitzkasten, with a Spitzkasten on each side.

X Q. 43. And when did you first put in machines with the compressed air supplement in the Spitzkasten?

A. I think that was during the period represented by July 13 to July 23d on this sheet, I am not positive, but I think that period covers the first installation of that type, with the air cells.

X Q. 44. These air cells, have they double Spitzkasten or single Spitzkasten?

A. Well, there is an air cell in each Spitzkasten.

X Q. 45. But are they double Spitzkasten machines, or single Spitzkasten machines?

2541 A. Double.

X Q. 46. Double?

A. Yes, sir.

X Q. 47. Now, in this slime vanner tailings plant, how many of the machines had the compressed air addition?

A. Well, all of them that we term rougher cells have this in.

X Q. 48. All the rougher cells?

A. Yes, sir.

X Q. 49. But the cleaner cells they don't have that?

A. The cleaner cells, the first two rows of machines on our pyramid type of cleaner are the mechanical machine, but the two lower rows have the air cells in them. They are all double Spitzkasten.

X Q. 50. Do the lower machines that have the compressed air, do they make a finished concentrate?

A. Most generally. Sometimes we might circulate that product, but not very often.

X Q. 51. That is to say, if the operation of the machines, your examination should show that it was not as good as it ought to be, you would send it back?

A. Well, sometimes it has been the custom to do that.

X Q. 52. But that is not the general custom?

A. Not the general practice.

X Q. 53. You haven't got with you, have you, a flow sheet of the mill or of the flotation plant?

2542 A. I haven't, Mr. Williams.

Mr. Williams: With the reservation that was made with regard

to the other witness in view of the total lack of application of his testimony, I would like to reserve the right at a future time to continue the cross examination.

Mr. Scott: That is all.

Witness excused.

THOMAS A. JANNEY, a witness called on behalf of the defendant being first duly sworn, testified as follows:

Direct examination.

By Mr. Scott:

Q. 1. What is your full name?

A. Thomas Addison Janney.

Q. 2. And what is your occupation?

A. Superintendent of the Arthur plant of the Utah Copper Company.

Q. 3. At Garfield, Utah?

A. Garfield, Utah.

Q. 4. And what are your duties in that position?

A. I am in full charge of the operations of the plant.

Q. 5. And that plant is made up of a flotation department is it, and gravity concentration?

A. It is.

2543 Q. 6. How long have you held that position, Mr. Janney?

A. Since June 1, 1915.

Q. 7. And before June 1, 1915, what was your occupation?

A. I was a metallurgical engineer.

Q. 8. Of the same plant?

A. Of the same plant.

Q. 9. And for how long a period were you metallurgical engineer?

A. I believe it was July 11, 1911, when I was made metallurgical engineer of the plant.

Q. 10. And, as metallurgical engineer did you have anything to do with flotation?

A. I had full charge of the flotation work.

Q. 11. The practical work and the laboratory investigations, both?

A. Both.

Q. 12. In these flotation operations, what was the nature of your first work in the laboratory?

A. Our first work in the laboratory was made for the cleaning of the low grade concentrates, which were produced by the vanner in the mill, and we worked on it in a general way trying to find a suitable oil for raising the grade of the concentrate.

Q. 13. Did your investigation extend over a long period?

A. It did.

Q. 14. For how long a period did the investigation con-

2544 tinue before any actual, full, scale operations were attempted?

A. I believe our experiments started in the early part of 1913, and we started commercial operations in February of 1914.

Q. 15. About a year of investigation?

A. Yes, sir.

Q. 16. In a general way, was it necessary to carry on such a protracted investigation?

A. I will correct that statement; it was the year 1915, some two years before we first started actual operations.

Q. 17. Two years of investigation in the laboratory?

A. Yes, sir.

Q. 18. I asked you why it was that so much investigation was necessary.

A. When we first started in we knew nothing about the flotation process.

Q. 19. Was the literature of the art and the product accessible to you?

A. Yes.

Q. 20. You had that assistance in your first investigation?

A. I think that I did read some patents, but they were of no assistance that I could see.

Q. 21. When you started the flotation in the plant upon a practical scale, what amount of oil did you use in a general way?

Mr. Garrison: I suppose this is as good a time as any to
2545 interpose the objection for the reasons given in the objection to the testimony of Mr. Wicks.

The Court: Objection overruled.

Plaintiff excepted.

A. Well, our oil varied from a pound and a fraction up to 80 pounds when our experiment first started.

Q. 22. By experiments do you mean operations in the mill or in the laboratory?

A. That was in the laboratory.

Q. 23. But during the first part of your mill operations what was the quantity of oil, state it generally?

Mr. Garrison: Now, your honor, I think we are entitled to have the defendant indicate to us what part of the prior art the testimony of this witness will be devoted to and with respect to which the testimony of this witness is offered.

The Court: What is the object of this, Mr. Scott?

Mr. Scott: The operations of the Utah Copper Company comprise the steps that are set forth in the Everson patent, the Kirby patent, the Froment patent, and the California Journal of Technology. As to the quantity of oil, the range of oil used by the Utah Copper Company has been both more and less than that indicated in the California Journal of Technology. The agitation, the grinding of the ore, its mixture with water, the addition of the oil, the agitation, the frothing, each step is represented in the various prior art documents. If it will be of any assistance or serve any other purpose than delay, I would
2546 analyze all these patents for Mr. Garrison's benefit. I don't think it is necessary or profitable to do that at this time.

The Court: This case, of course, is being tried virtually the same as though the Hyde case never existed. Certainly the Hyde case was brought after this time, and we understand of course that it is the state of the prior art at the time the complainant's patent prevailed which is in question. Under the statement of Mr. Scott I think he is proceeding fairly. The objection is overruled.

Plaintiff excepted.

A. We used in the neighborhood of from two to eight pounds.

Q. 24. That was for what period of time?

A. That covers a period from 1915 up to and inclusive of December 21st, 1916.

Q. 25. Is the memorandum or table that you are consulting something that was prepared under your direction?

A. It was prepared under my direction, yes.

Q. 26. You have knowledge of its accuracy, have you?

A. Not to every figure, but I have no reason to believe that they are not accurate.

Q. 27. They were prepared under your supervision, and they are figures which you rely upon in your business, are they?

2547 A. Absolutely.

Q. 28. To that extent you can testify to the accuracy of the figures here set forth?

A. I can.

Mr. Scott: I offer this tabulation in evidence at this time for the convenience of all parties, as the testimony will be based on it.

Mr. Garrison: A word of cross-examination before it is admitted.

The Court: Yes.

By Mr. Garrison:

Q. 29. Mr. Janney, is your relationship toward the various things set forth on this paper such that of your own knowledge you can disclose to us the source of the information and the accuracy of the results as tabulated upon this sheet?

A I might explain that during the year 1915 I was not at the plant, but I have been there the balance of the time.

Q 30. Then with respect to all of 1915 you have no personal knowledge?

A. I have no personal knowledge, except that I know the results are correct.

Mr. Garrison: We object to the introduction of this document which has records for every month in 1915.

Mr. Scott: Yes. I will offer it subject to further proof.

Q. 31. Who was in charge at that time?

2548 A. My brother, Frank G. Janney.

Mr. Scott: I offer it provisionally, subject to proof by Mr. Frank G. Janney.

By Mr. Garrison:

Q. 32. With respect to everything that appears on this sheet headed "Utah Copper Company, Arthur plant, February 1st, 1915, to April 8th, 1917, inclusive," is the fact of your personal knowledge with respect to the operations of this plant such that you can testify as to the sources of these figures and their accurate representation of the truth?

A. I can except for a few days in the month of May, 1916, and a few days in October and November, when I was away from the plant.

Q. 32½. Then, otherwise, when you would be present, you have information in regard to these operations which would enable you to answer the questions concerning the results and the accuracy of these representations?

A. I am.

Mr. Garrison: I have no objectionn to the form, except the objection that I stated.

The Court: It will be admitted and it may be used by the witness to the extent of what he says he has knowledge of.

Tabulation presented by Mr. Janney marked Defendant's Exhibit 30, and admitted in evidence.

2549 By Mr. Scott:

Mr. Scott: As far as the mere explanation of the table goes, I presume I may ask for the witness' comments on it, that is, its meaning and significance.

Q. 33. I notice the first column is headed "estimated tons treated." State in a general way how you estimate that tonnage?

A. Our plant is so arranged that during the time mentioned, from February, 1915, up to and inclusive of December 1st, 1916, that we could not take a tonnage sample of the material treated, but from our assays we calculated the amount of concentrate produced. At the Magna plant of the Utah Copper Company, they took tonnage samples of the concentrate treated in flotation, and they compared that with the tonnage treated in the large mill proper, and inasmuch as the flow sheet of the mills are practically the same, we used their factor in order to determine the tonnage for the months mentioned.

Q. 34. Now, I notice that the upper part of this table, beginning February, 1915, and extending to December 21st, 1916, the amounts of oil range below six pounds; in the part of the table below, covering the period from December 22nd to April 8th, I notice two oil columns, one headed "new" and the other headed "circulating." I would like to have you explain the meaning of the circulation oil items, if necessary explaining the layout of the plant first, to make it clear?

A. Up to and including July 11th, 1916, we had one flotation plant in operation for the treatment of our low grade concentrates,
2550 consisting of two emulsifier cells and thirteen frothing cells; from July 12th, 1916, to April 8th, 1917, inclusive we had

two plants in operation for treating the same material. The second plant is composed of two emulsifiers and fifteen cells. The low grade concentrates, which concentrate we feed to these plants, is the overflow from the mineral classifier, which classifies the low grade concentrates produced by the vanners in the mill; which overflow is removed to two forty-four foot Dorr thickeners. The overflow from the Dorr thickeners is sent to waste; that is, it is not returned in the circuit, and the thickened product is divided and sent in approximately equal proportions to the two flotation plants. The feed going to our old plant runs by gravity from the Dorr tank, but the feed going to the new plant is pumped, due to a difference in the elevation of the plant and the Dorr tank. The pulp from the Dorr tank enters first the emulsifier, where oil is added, and then goes to the second emulsifier, thence to the first cell of the series of frothing cells. A high grade concentrate is made by the first few cells, and the balance of the concentrate produced is returned through our retreatment plant, thence back to the Dorr thickener.

Q. 35. Returned to what?

A. To the mechanical treatment plant where the vanner concentrate is classified. The flotation plants are so arranged that the middling will return to the mechanical treatment plant, and is elevated to the classifier and the overflow is then returned to the Dorr
2551 thickeners, as previously explained, in that way the middling is kept in circulation.

Q. 36. And the thickened product goes where?

A. It goes back to the head of the flotation machine.

Q. 37. And that is what you call the circulating load, is it?

A. Yes, sir; it joins the original feed when it enters the classifier. The concentrate made by the first few cells is sent to a Portland filter and the tailings are rejected.

Q. 38. Now, the question that I started out with was this heading of the table "New oil" and "circulating oil." Will the explanation of the machine so far given enable you to explain about the circulating oil?

A. I think so.

Q. 39. Suppose you tell us about that?

A. The concentrate which goes from the lower cells, which I spoke of as the middling, is sampled, and the quantity of the middling is determined by tonnage samples, and from this sample we determine the amount of oil which was in the flotation middling. Now, this column, "new oil" is the amount of oil added for each ton of new feed entering the flotation machine.

Q. 40. That is, excluding the middling?

A. Yes, excluding the middling.

Q. 41. So much per ton of absolutely new material?

A. Yes, sir. The figures under the circulating oil column
2552 are the figures which we credit as new oil. Now, we get that credit in this way: we figure that each ton of middling should carry twenty pounds of oil per ton, and all the oil in excess of that we credit as new oil and we credit that to our new tonnage.

Q. 42. That is why you have this tonnage column in which you have added up the new oil and the circulating oil.

A. Yes, sir.

Q. 43. What would you do in the event the middling would not carry its own share of the oil—that is carry less than twenty pounds?

A. Then we would have to add more new oil to make up the deficiency.

Q. 44. More than that necessary for the original feed, you mean?

A. Yes, sir. That is, we try at all times to have twenty pounds of oil per ton of material in the machine.

Q. 45. Whether the oil goes there with the middlings or is original oil?

A. Yes, sir.

Q. 46. Will you make a comparison from a metallurgical viewpoint of the results prior to December 22nd, and those beginning on December 22nd and extending to date?

A. From the time we started the plant, and up to and inclusive of December 21st, we rejected tailings from the flotation plant which assayed .361 per cent copper, and produced a concentrate
2553 that contained 26.800 copper, and made a recovery of 96.57 per cent. During this period we used 3.76 pounds of oil per ton. Covering the period from December 22nd, 1916, to April 8th, 1917, we treated 63,176 tons of material, and rejected a tailing that assayed .238 per cent copper, and produced a concentrate containing 22.180 per cent copper, and made a recovery of 96.60 per cent, using 21.98 pounds of oil per ton.

Q. 47. Which operation represents the most profit—that is, which class of operation?

A. Well, the method which I will designate as the twenty pound method. When we use 3.76 pounds of oil per ton we rejected a tailing that contained 7.22 pounds of copper per ton, and with the method using 20 pounds of oil, or what I have designated as the twenty pound oil method, we rejected a tailing which only contained 4.76 pounds of copper per ton, which shows an additional saving of 2.46 pounds of copper.

Q. 48. Taking into consideration other factors would the large amount of oil show a greater profit?

A. It would.

Q. 49. Mr. Janney, the figures given for copper, iron, insolubles, tailings, etc., are percentages, are they not, all through?

A. Yes, sir.

Q. 50. I see the per cent. indication is omitted from the copy that I have, but all these figures are percentages, are they not?

A. Yes, sir.

Q. 51. In the answer you have just given you applied
2554 those percentages to a ton of 2,000 pounds and made your calculation that way?

A. Yes, sir.

Q. 52. During this period from December 22nd to April 8th for which you have monthly averages, can you state whether large

amounts of oil—considerably larger than are shown in the average—were used on any individual days?

A. From April 1st to April 8th we were making some special experiments, and during that time we used very small quantities and very large quantities. That is why the tailing assay is much higher than during the previous months.

Q. 53. You mean on account of the fact that you were performing experiments?

A. Yes, you see here I used a very small quantity of oil in this case, and the tailings are very high, and those results are included in this average.

Q. 54. Have you the statement of those experiments?

A. Yes, sir.

Q. 55. Were these experiments performed by you personally or under your personal direction?

A. Under my personal direction.

Mr. Williams: Where were these experiments performed and when?

Mr. Scott: If you will be patient, Mr. Williams, I will ask him.

Mr. Williams: I object to testimony about experiments, which can so easily and readily be performed in court, as secondary.

2555 Mr. Scott: If you will wait a minute, he will calm you.

Q. 56. Where were these experiments done, and in what kind of plant?

A. In the same plant that I have just testified to.

Q. 57. That is the full sized flotation plant of the Utah Copper Company?

A. Yes, sir.

Mr. Williams: Will you give us access to that plant for examination when we wish it?

Mr. Scott: Certainly, to where these experiments were performed and these runs.

Mr. Williams: And the other one of which he has testified?

Mr. Scott: We will let you see what pertains to this case and the flotation matters he has testified about.

Mr. Williams: The objection will be withdrawn.

Mr. Scott:

Q. 58. Are the results set forth in this statement which you have in your hand correct to your knowledge?

A. They are.

Mr. Scott: I offer a copy of the statement in evidence to which the witness is referring.

Table admitted in evidence and marked Defendant's Exhibit No. 31.

Q. 59. Now, Mr. Janney, I think I will let you explain in your own way the purpose of these experiments and what you did,

2556 but before starting in I wish to ask you as to the character of the apparatus and the scale of the operation and what was done with the concentrates?

A. In these experiments I had to take all the feed that was going to the flotation plant, and that was controlled by the amount of ore treated in our mill, and the concentrates produced were sent to the smelter as in all cases with our concentrates, and the tailings were rejected. The plant that I performed these experiments in was the regular plant used for cleaning the concentrates, and no alterations or changes were made in any respect.

Q. 60. Were any changes made in the mode of operation of the plant?

A. None whatsoever. We tried to operate the plant to get the best results we could in each case. There were a few conditions varied probably in the dilutions of the pulp, but that was done to accomplish the best results we could. On the day shift of March 30th——

Q. 61. The dates do not appear here, do they?

A. I noticed last night that the dates were not there but I will testify as to the dates.

Q. 62. They are all numbered in a serial order from one to thirteen?

A. Yes, sir.

Q. 63. Were these things done on succeeding days?

A. No. Whenever an experiment would come to my mind that I would like to perform, I carried it out.

2557 Q. 64. Well, then, if you refer to them by dates you better tell us what number it is here so we will know.

Mr. Williams: Go down consecutively.

A. I will go down consecutively. Experiment No. 1 covered a period of eight hours on the day shift of March 30th. We treated 151 tons of dry feed. We used 1.6 pounds of oil per ton of new feed and we credited to our new feed 6.31 pounds of oil which was contained in the circulating feed.

Q. 65. Before we go on: Was that 6.31 in the circulating feed on the basis of the 20 pounds as you explained a moment ago?

A. No, sir.

Q. 66. In that event, you haven't added the oil in the circulating load?

A. We determine the total oils—we determined the total amount of oils in the circulating load and considered that amount as new oil. There was no reason to credit 20 pounds of oil to these experiments because we were trying to get a certain number of pounds of oil per ton. The total oil used per ton of new feed was 7.91 pounds and the total pounds of oil per ton of total feed which includes the circulating feed with the initial feed was 6.87 pounds.

Q. 67. So that the column "per ton total feed" represents, takes into consideration all the oil, does it and all of the solids, does it, whether circulating or not?

A. Yes, sir. During that period the tailings rejected con-

2558 tained 1.577 copper and the concentrates produced contained 18.325 per cent. copper, and the indicated extraction was 71.07. I might mention that the oils used for these experiments from 1 to 13 inclusive was a mixture of oil composed of 59 per cent. smelter fuel oil. It is an oil that comes from California which the smelter at Garfield uses as fuel oil and thirty per cent. of Jones oil which is a topped petroleum oil and comes from Oklahoma. By a "topped oil" I mean an oil that has had the gasoline and kerosene removed; and ten per cent. American Creosote No. 2 which is a coal tar derivative, and one per cent. Yaryan pine, which is a steam distilled pine oil.

Q. 68. Steam distilled?

A. Yes, sir, it is not destructively distilled. Would you like me to testify to all of these results?

Q. 69. I would like you to make a comparison, briefly, of the different experiments in the first tabulation, as to the amount of oil and as to the tailings and grade of concentrates, and the indicated extraction?

A. Experiment No. 6 was made on the 25th of March, duration of the test was twenty-four hours.

Mr. Williams: What number was that, 6?

A. No. 6. The total oil used for that test was 20.97 pounds per ton of total feed. The tailings rejected contained .141 per cent. copper.

Mr. Scott:

Q. 70. How does that compare with the tailings in this first experiment, on the first days when you used six pounds and eight tenths of oil per ton?

2559 A. Was very much lower, very good results. I might mention that during that twenty-four hours we treated 627 tons of ore, initial ore.

Q. 71. Is there any general trend in the character of these results as the quantity of oil is varied?

A. The results improved as the quantity of oil was increased. In this particular test we made a 97.76 per cent recovery against 71.07 when we used 6.87 pounds per ton. The grade of concentrate was 24.50 per cent copper against 28.10.

Q. 72. No, you read the wrong figure, didn't you; didn't you read out of the "iron column" instead of the "copper" when you said 24.5?

A. It should read 18.692 per cent copper against 18.325 per cent copper. I will just take two or three experiments at random.

Q. 73. Suppose I put a question or two to you, Mr. Janney. I notice that the variation in the amounts of oil in these thirteen experiments is from 6.87 pounds to 96.46 pounds and that the increase in the different runs has been made in fairly regular increments. Now, can't you give us a brief statement as to the effect of that increase in oil upon the tailings and the concentrates and the extraction, as an entirety without reading the individual figures in all cases?

A. As the oil was increased in these experiments the result—the

tailings rather were lower and the grade of the concentrates remained practically the same and the recovery increased. That is up
2560 to experiment No. 7 where we used 25.50 pounds of oil per ton, total tonnage. And the results were even comparable down to where we used 59.39 pounds of oil per ton of total feed. In that case the tailings contained .166 per cent copper and the concentrate contained 17.099 per cent copper, and the recovery was 97.26 per cent. Our tonnage was 572 tons per twenty-four hours.

Q. 74. Was there any falling off in the character of the results as you get to the extreme quantity of oil, 96 pounds?

A. The tailing was a little higher when we used 96.46 but still it was a commercial result, tailing contained .272 per cent copper and the concentrate was slightly lower.

Q. 75. Are the concentrates with that materially larger quantity of oil, 96, than in any other one of the experiments?

A. Well, the concentrate is practically the same you might say.

Q. 76. I notice they were lower with some of the smaller amounts of oil than with 96 pounds?

A. The concentrates throughout the whole test were practically the same. The difference is very small.

Q. 77. That is, speaking from a business standpoint, you would regard them just about the same, the concentrates?

A. Yes, sir, the concentrate in each case is commercial concentrate.

Q. 78. Now, what was the purpose of these experiments in
2561 the last group, No. 14 to 19 entitled "using 91 per cent American creosote No. 2, and 9 per cent Yaryan pine"?

A. These tests were made to determine if it were the American creosote and pine oil that brought about these good results.

Q. 79. You mean independently, do you?

A. Yes, sir; that is to say, I wanted to determine if this smelter fuel and Jones oil played any part in the production of the good results.

Whereupon an adjournment was taken until 2:00 p. m., of this day, Thursday, April 19, 1917.

2:00 P. M., April 19, 1917.

Mr. Janney.

Direct examination (resumed).

By Mr. Scott:

Q. 80. Mr. Janney, I don't think I asked you the description of the material this low grade concentrate, which is the subject of these experiments with large quantities of oil—what that is, that low grade concentrate.

A. That is the overflow from the mineral classifier.

Q. 81. About what degree of fineness is it?

A. There is only 2% of the material that will stay on a
2562 65 mesh screen, having an opening of .0082 inches.

Q. 82. Have you any figures as to how much will pass through finer screens?

A. 36% will pass through a 200 mesh screen, having an opening of .0020 inches.

Q. 83. Will you state once more the object of these experiments, numbered from 9 to 14, in this summary of results of experiments on low grade concentrates?

A. The oil used in these experiments was a mixture made up of American creosote No. 2 and Yaryan pine oil, which was used with the smelter fuel, and Jones oil in the experiments from 1 to 13 inclusive. My object in using this oil in these experiments was to determine whether or not this oil alone was responsible for the high recovery made.

Q. 84. That is, whether the American creosote and Yaryan pine did the work or not? And so you used them alone to find out?

A. Yes, and I tried to use the amount that was used in certain experiments, numbered 1 to 13. Take, for example, experiment No. 14, in which I used .61 of a pound of oil composed of American creosote No. 2, and Yaryan pine; that would correspond to experiment No. 1; that is, .61 of a pound would approximate the amount of this oil mixture used in experiment No. 1.

Q. 85. Just explain that a little. In experiment No. 1
2563 the total oil was 1.39 pounds. Now what relation has this .61 to that?

A. The total used in experiment No. 1 was 6.87 of oil.

Q. 86. Oh, yes, 6.87. What relation has this .61 pounds in experiment 14, to 6.87 pounds in experiment 1?

A. In experiment 1 it will be noted that in the oil used there was 11% of oil composed of American creosote No. 2 and Yaryan pine, and 11% of 6.87 would be .76; so the experiment No. 14, in which I used .61 pounds of American creosote and Yaryan pine, would approximate that figure.

Q. 87. Explain why you did not get the exact amount in experiment 14 that would correspond to 11% of 6.87 pounds in experiment 1?

A. You can not tell exactly how much ore is going through the machine; and we have to calculate the amount as near as possible.

Q. 88. Now, if I understand you, that .61 pounds in experiment 14 of creosote and pine mixture, corresponds roughly to the amount of those same two oils in the mixture used in experiment 1?

A. It comes very close.

Q. 89. That was the purpose of the experiment?

A. Yes, sir.

Q. 90. Now you may proceed and describe the relation between the others, if you wish to.

A. In experiment No. 14, in which I used .61 pounds of
2564 American creosote No. 2, and Yaryan pine oil, I treated 53 tons in two hours, and the tailings rejected contained 3.433% copper.

Q. 91. How does that compare with the tailings obtained when you used these same two oils with the addition of smelter fuel and Jones oil?

A. It was over twice as high.

Q. 92. Now you may compare the extraction.

A. The extraction made while using .61 creosote and Yaryan pine was 29.54%, while in experiment No. 1 the recovery made in that extraction was 71.07, showing that the recovery was more than twice as high.

Q. 93. When you used the mixture including all four of the oils?

A. Yes, sir.

Q. 94. Now, do these other experiments numbered from 5 to 19, correspond in quantity of creosote and pine, with the amount of those ingredients used in some of the experiments between 1 and 13?

A. Approximately, yes.

Q. 95. Indicate which ones correspond, or if you have a column which indicates that, just point it out and name it—I see a column here at the right which says: "Refer to Exp." Is that the column that indicates the corresponding experiment?

A. Yes, sir.

Q. 96. The numbers in the column as I have it—it has been corrected—are, reading from the top, 1, 3, 4, 5, 6 and 8. Is
2565 that the corrected form, the proper form?

A. Yes, it is.

Q. 97. Now, just make a comparison between, say, experiment 19 and experiment 8 in the matter of efficiency of the two operations.

A. In experiment No. 8 the tailings rejected contained .251% copper, while in experiment No. 19 the copper contained in the tailings was 1.217%.

Q. 98. That is about four or five times as much?

A. That is about five times as much.

Q. 99. And how about the extraction in those two cases, Nos. 19 and 8?

A. In experiment No. 8 the extraction was 95.19, while in experiment No. 19 the extraction was 84.02%.

Q. 100. Something over 10% under?

A. Yes.

Q. 101. What is the purpose of the last experiment recorded here, No. 20, in which you used 60% of smelter fuel and 40% of Jones oil?

A. The object of that experiment was to determine whether this oil alone could produce any results.

Q. 102. Does that experiment at the bottom of the page No. 20, correspond in the amount of smelter fuel and Jones oil with any experiments between 1 and 13? I see you have 17.84 pounds of oil in No. 20. Does it compare with No. 6?

A. I think that is the closest one.

Q. 103. And how have you found out, by taking what per cent of the twenty——

2566 A. (Interrupting.) The object of running this test, Mr. Scott, was to determine if 20 pounds of this oil alone would bring about a commercial result.

Q. 104. Regardless of the comparison with the other?

A. There was no comparison between the two experiments.

Q. 105. And compare the results you thus obtained, using the fuel experiments, as to concentrate, tailings and extraction?

A. In that test I endeavored to use twenty pounds of oil, but we were off on our calculations and it only amounted to 17.84 but even though the oil was a little low it compared very favorably with the test in which I used other oil and fuel oil and Jones oil. Take for example No. 4, the tailings are practically the same although the oil is greater comparably. In one it was 14.53 pounds against 17.84.

Q. 106. But the 14.53 in experiment No. 4 is of the entire mixture, containing the four ingredients?

A. Yes, sir. Experiment No. 6, if we eliminate the American creosote and the Yaryan pine we would get approximately the same amount of oil that was used in experiment No. 24. In experiment No. 6 the tailings was fourteen hundredths against the .306 in experiment No. 20.

Q. 107. Showing the entire mixture was more efficient than the smelter fuel and Jones oil alone?

A. Yes, sir. Smelter fuel and Jones oil lack frothing prop-
2567 erties, properties to bring about the whole recovery.

Q. 108. And that is contributed by the other ingredients, the creosote and the Yaryan pine?

A. Yes, Yaryan pine and creosote is used to produce the bubbles or create the froth, although this froth produced in experiment No. 20 was identical, but with a little more frothing oil added to it I would get a much better result.

Q. 109. You mean identical in what, appearance?

A. Yes, sir. You had your air bubbles with the mineral attached to it.

Q. 110. Well, from this tabulation, exhibit 31 that we are considering, would it appear that the smelter fuel and the Jones oil contributed more to the result than the American creosote and the Yaryan pine?

A. It would seem that the smelter fuel and the Jones oil contributed the most to the result because 95.06 recovery was made by its use alone.

Q. 111. Compare that with the recovery which was made in experiment 13 where you used 96.46 pounds of oil per ton you find what?

A. In experiment 13 where we used 96.46 pounds of oil per ton of feed the recovery was 95.39 per cent; while in the case of experiment No. 20 the recovery was 95.06.

Q. 112. And how about the comparison between the copper in the tailings?

A. Experiment No. 13 the copper in the tailings was .272;
2568 while in experiment No. 20 the copper in the tailings was .306.

Q. 113. This morning, in discussing the method of figuring tonnages, you stated that a factor had been established at the other mill; the Magna mill which you used in the Arthur mill. Are you certain that that is the method of calculating tonnage at the Arthur mill?

A. After leaving the court room I began to think about it and I was not sure as to whether that factor was established at the Magna mill or whether we had established it at the Arthur plant after we started taking the tonnage samples.

Q. 114. But in either event there is a factor established and that you used as a basic of calculations?

A. Yes, sir.

Q. 115. Is there any peculiarity about the ore of the Utah Copper Company, which you are accustomed to handle at the Arthur mill and Magna mill?

A. In one particular, regarding flotation. I have found that our ore is much more difficult to treat when it is freshly crushed than it is after it has been allowed to stand in water for several days. The age of the ore in the presence of water seems to make it much more amenable to treatment than when it is freshly crushed.

Q. 116. Well, in actual practice, how long has the ore been crushed and subject to moisture before it does reach your flotation department?

2569 A. It would be just the matter of a few hours.

Q. 117. Long enough to assist any in the flotation operation?

A. I think not.

Q. 118. You think it could be handled better if the time interval was lengthened?

A. Yes, sir. I know it to be a fact.

Q. 119. Have you operated the Arthur plant or any part thereof upon slime feed with varying quantities of oil and in a manner similar to that you have just described with reference to the low grade concentrate?

A. I have.

Q. 120. This work was done by yourself personally or under your supervision, was it?

A. Under my supervision.

Q. 121. Have you recorded the result?

A. I did not record the results myself, but I had them tabulated.

Q. 122. You have a record of that with you?

A. Yes, sir.

Q. 123. Similar to the copies I have?

A. Yes, sir.

Q. 124. You know of your personal knowledge, do you, that this record is a correct record of what was done?

A. Yes, sir.

Q. 125. And it is so correct?

A. Yes, sir.

2570 Mr. Scott: I presume there is no objection at all other than the original objection to this exhibit?

Mr. Williams: It is understood that the objection, having been stated, need not be repeated every time.

The Court: The record will so show.

Record of operations of Arthur plant admitted in evidence and marked Defendant's Exhibit 32.

Mr. Scott:

Q. 126. This tabulation which has been received in evidence as exhibit 32 is entitled: "Summary of results obtained from commercial experiments on slime feed." Will you please explain what this slime feed is?

A. Why, the ore, as it comes from the mine, is in sizes ranging from two feet square approximately, and we reduce it in our coarse crushing plant to approximately three quarters of an inch and it is fed to our fine bins where it is recrushed in ball mills in our flotation section. The product from the ball mill goes over what we call a Garfield roughing table where the coarse mineral is removed. The tailings are elevated to a classifier—I might mention it is a hydraulic classifier—and the coarse sands are returned to Chilean mills and ball mills for regrinding. The overflow from the classifier goes to a 75 foot Dorr tank and the sand products of the classifier which are fine enough for concentration are treated on a vanner. The tailings from the vanner are sent to waste and the concentrate is sent to our retreatment plant.

2571 Q. 127. That is the plant you have just described?

A. That is the plant I have just described. And the thickened product from the Dorr tank constitutes our flotation slime feed.

Q. 128. About what degree of fineness is this?

A. Approximately 75 per cent will pass through a 200 mesh screen.

Q. 129. That is regarded as very fine slime, is it?

A. Yes, sir.

Q. 130. Did that present any difficulty in the way of flotation treatment other than the difficulties encountered in treating the low grade concentrate?

A. We had a great deal of trouble in working out a process for the treatment of this slime. Our experiment started, I believe, in the early part of 1913 in the laboratory and in the latter part of 1914 we built a slime plant at the Magna plant of the Utah Copper Company, and at that time I had charge of the operation.

Q. 131. Well, during that period what amount of oil were you using—about a year, wasn't it, you named in the investigation?

A. We used various amounts of oil. In 1914 the oil we used was in the neighborhood of one to five pounds.

Q. 132. Per ton?

A. Per ton, if my memory serves me correctly, we were not able to get any kind of a result there that would be consistent. One

2572 day we would get a low tailing and the next day our tailing would be high, and it was not until April, 1915, that we finally were able to treat our slime successfully.

Q. 133. 1915, that was, wasn't it?

A. It was 1915, I think it was. And then at that time we discovered a combination of oils and acid that gave us good results.

Previous to April of 1915—no, it was April of 1916. I was not at the plant in 1915—April, 1916. We had tried all kinds of creosote oil, pine oils, petroleum oils and almost every oil that we could get a hold of. We tried in combination with these oils certain alkalies, tried it in a neutral state and also in the presence of acid; and in April 1916, we discovered that by sulphinating a creosote oil and pine oil in the proportion of 95 per cent Barrett oil, which is a creosote oil, and five per cent pine oil and the use of acid we could get excellent results.

Q. 134. Have you since discovered any other combination of oils that are as efficient as this particular one that you have described?

A. Recently we have discovered that by using a large quantity of certain oils we can get very good results.

Q. 135. Is that the limit of the different ways you get at it—this particular oil that you have just mentioned—that kind of oil that you say you have used lately?

2573 A. Yes. Well, in July, 1915, on the 30th of the month, and previous to this time we had found some oils that would give us very good results, but we could not operate on account of the expense.

Q. 136. What caused the expense?

A. The large amount of oil required, and we had to use a certain oil, a special oil which we sulphinated, and we also had to use an alkaline solution.

Q. 137. How much of that oil did you have to use?

A. We used all the way from—I think it is two pounds up to 27.42.

Q. 138. And which amount gave the best results?

A. We had to use a large amount of oil.

Q. 139. I don't know just what you mean by a large amount.

A. Well, around 13 pounds.

Q. 140. Now, referring to this tabulation, exhibit 32, relating to the slime treated, is the oil mixture recorded upon that sheet the same as that which you used in your large amount of oil experiments on the low grade concentrate?

A. It is not the same oil.

Q. 141. You did not find the same oil applicable to both kinds of material?

A. No, sir.

Q. 142. What was the purpose of these experiments numbered from 21 to 29?

2574 A. I had found from laboratory tests, using large quantities of oil, and I wanted to verify my results on a larger scale of operation, and that was the purpose of these experiments.

Q. 143. Did these large scale operations of the mill coincide with what you had concluded from your laboratory work?

A. Yes, sir.

Q. 144. Will you give a statement of the effect you found from increasing the amount of oil in these successive experiments from 21 to 29?

A. I found that after we got above 56 pounds of oil per ton the results were practically the same.

Q. 145. The concentrates in the last three there, 27, 28 and 29, where the amount of oil was 56 pounds or above, were what in copper?

A. Experiment No. 27, in which we used 56.99 pounds of oil per ton, the concentrate assayed 16.400% copper. In experiment No. 28, where I used 78.40 pounds of oil per ton, the copper in the concentrate was 14.30. In experiment No. 29 where I used 99.43 pounds of oil per ton, the concentrate assayed 15% copper.

Q. 146. Now how did the tailings vary with the increase of oil from experiment 21 to 29?

A. Their copper content lowered as the amount of oil was increased, with the exception of one day.

Q. 147. And that was which one?

A. That was experiment No. 22.

Q. 148. I see in experiment 22 the tailings went up; that is, with the smaller amount of oil in experiment 21, the tailing was
2575 .18, and in experiment 22, with 11.36 pounds, the tailing went up to .475, and that after that there seems to be a general decrease in the tailings with the increase of the oil. Can you explain that irregularity in any way?

A. There are certain conditions that may arise in the plant——

Q. 149. You don't know the precise condition, do you?

A. No, I don't.

Q. 150. But with that exception, the increase of oil seems to accompany a decrease in the tailing, does it not?

A. Yes, sir.

Q. 151. At the bottom of this sheet, exhibit 32, there are 4 experiments recorded, as 30 to 33 inclusive. Will you state the purpose of those, and how they served that purpose?

A. In experiments 21 to 29 I used a mixture of oil composed of a mixture made up of 60% No. 34 degree paraffine base distillate, and 40% of gilsonite, and another, mixture composed of 95% Barrett No. 4 creosote and 5% Yaryan pine. These two mixtures were combined in the proportion of 98 and 2% respectively.

Q. 152. As indicated at the head of the sheet?

A. Yes, and in experiments No. 30 to 33 inclusive, I used a mixture of oil composed of 95% Barrett No. 4 creosote and 5% Yaryan pine oil.

Q. 153. Corresponding with the second ingredient of the mixture used above?

2576 A. Yes. My object in running these experiments, 30 to 33 inclusive, was to determine whether or not this particular mixture of Barrett No. 4 creosote and Yaryan pine was responsible for the high recovery made.

Q. 154. And what did you find out from these experiments?

A. I found that the amount of Barrett creosote and Yaryan pine oil used in experiments 21 to 29 inclusive was not responsible for the high degree of recovery.

Q. 155. As a matter of fact how do the recoveries compare?

A. Well, they are not comparable at all.

Q. 156. These recoveries are correctly stated here, are they, 9.88% and .69%, and 16.40% and 1.33%?

A. Yes.

Q. 157. That is practically nothing in the way of a recovery is it?

A. I would not consider it a good recovery. Those oils were used in that mixture merely as frothing agents.

Q. 158. Can you state what your conception is of a frothing agent as determined—as distinguished from an oil that is not a frothing agent?

A. I have run across a great number of oils that in themselves do not possess the properties of creating froth when they are agitated, but they have a quality or property of selecting the mineral from the gangue. Then there is another class of oils which I call frothing agents, which are capable of producing froth, and making the air bubbles stable.

2577 Q. 159. But do they necessarily gather up the mineral?

A. Well, these particular oils themselves have a slight selective action, but the degree of recovery is very low.

Q. 160. As here in experiment 32?

A. Yes, sir, the Barrett creosote and Yaryan pine.

Q. 161. Those are frothing agents?

A. Yes.

Q. 162. And in that particular instance, did they seem to do much besides contribute the frothing quality?

A. They did not, or they would have made a higher recovery.

Q. 163. How many oils or mixtures of oils do you know that will be operative in flotation of this slime feed of the Utah Copper Company?

A. There are two oils—two mixtures of oils, rather, that can be operated on a commercial scale, economically.

Q. 164. Are those the ones you have mentioned, the sulphinated oils?

A. The sulphinated oils and the gilsonite mixture.

Q. 165. That you have actually used?

A. Yes.

Q. 166. Do you know of any other oils that are operative?

A. No, I do not.

Q. 167. How many different oils do you suppose you have tried and investigated in your search for an operative oil?

2578 A. I think we have in our laboratory some thousand oils.

Q. 168. Have you tried them both alone and in mixture?

A. Yes, sir.

Q. 169. And these two combinations are all that you have discovered?

A. That is all.

Q. 170. Have you ever had any difficulty in getting oil in sufficient amounts for the purpose of running your plant with over 1% of oil?

A. We would be operating our slime plant now, if we were able to get oil in sufficient quantities to keep it going.

Q. 171. About how much oil would it take per day to keep it going, in rough figures?

A. It would take about 10,000 gallons a day to keep our present plant in operation.

Q. 172. How many tank cars would that be?

A. That would be one tank car. That is just for our slime plant, however.

Q. 173. For the Arthur plant?

A. For the Arthur plant alone.

Q. 174. And the Magna plant is about the same size?

A. Well, that is just for the slime treatment, and it would take about 1,500 gallons per day for the retreatment plant, and the Magna plant would take about the same amount.

Q. 175. Can you form any estimate as to the amount of
2579 oil it would take if you were to use flotation to its fullest extent in the Arthur and Magna mills?

A. It would take 87,500 gallons of oil per day.

Q. 176. And how much reserve oil is it necessary to carry?

A. We should carry at least 60 days' oil on hand, to protect ourselves against any unforeseen difficulties that might arise.

Q. 177. Was there any other occasion besides those days in July, 1915, upon which you used a large amount of oil—a comparatively large amount—previous to your present operations, I mean?

A. What do you mean by a large amount of oil?

Q. 178. Above ten pounds.

A. I believe during the months of June, July, August and September, the amount of oil we used per ton was near 13 pounds.

Q. 179. What year?

A. 1915.

By Mr. Garrison:

Q. 180. I thought you were not there that year.

A. I was not.

Mr. Garrison: I move that that testimony be stricken out. He was not there.

The Court: I think that portion of his testimony should be stricken.

Q. 181. What can you state as to the comparative occurrence of these froths with small and large amounts of oil?

A. There is practically no difference, except in the case
2580 where we used an extremely large amount of oil, such as a hundred pounds, the froth looked a little more oily.

Q. 182. What can you say as to the efficiency of the results with the same amount of oil in the laboratory operations as compared with operations in the mill?

A. Why, our mill operations have always checked, or even were better than our laboratory experiments.

Q. 183. When you increased the amount of oil to 20 pounds recently, did you make any changes in the plant or in the operation of the machinery?

A. None whatsoever.

Q. 184. You mean that you simply turned on more oil?

A. We had to prepare a means for taking a tonnage sample, but that did not change the flotation plant itself. The machines were not touched, or any of the conditions varied whatsoever.

Q. 185. Now, have you any information as to the amount of oil that goes off with the concentrates and with the tailings, do you know as to what becomes of the oil generally, when you are using these amounts above 20 pounds per ton?

A. In the retreatment of our low grade concentrate, I found that approximately 92% of the oil rejected from the plant was contained in the concentrates, and about 8% in the tailings.

Q. 186. Did you make determinations as to the amount of oil that the middlings had or returned to the head of the machine?

2581 A. Yes, sir.

Q. 187. Have you any figures or recollection as to what they carried?

A. I have. When we are operating with about 20 pounds of oil per ton I found about 60 pounds of oil per ton is in the middlings.

Q 188. That, to the ton, the middlings carry 60 pounds of oil?

A. That is what I was trying to say, yes. In the case where we used 36.45 pounds of oil per ton for the total feed, our concentrate on that particular day, contained 111.18 pounds per ton of concentrate, and the tailings contained 8.20 pounds of oil per ton for the tailings, and the middlings contained 36.75 pounds per ton for the middlings. Of course the amount of oil in the middlings varies with the mode of operation.

Q. 189. Now, the return of that middling carrying 36 pounds of oil per ton—I will omit the fraction—has what effect on the oil supply at the head of the machine when you are attempting to supply 1% of oil to the solids being treated?

A. In this particular case where there is 36 pounds per ton of the middlings, we credit to the total oil used, 12 pounds, and that multiplied by the tonnage of middlings would be the total amount of oil that would be credited as new oil.

Q. 190. Twelve pounds, would you say?

A. Well, the middling takes 36 pounds per ton, and it would take 20 pounds of that to satisfy the middling—Oh, I beg your

2582 pardon; I should have said 16 pounds.

Q. 191. You mean that 16 pounds would be credited as new oil?

A. 16 pounds would be credited as new oil, and in order to get the total amount of oil that we would credit, we would have to multiply that by the tonnage of middlings.

Cross-examination.

By Mr. Williams:

X Q. 192. That figure that you gave of 60 pounds of oil to the ton of middlings, where did you get that from?

A. That was just one particular day that I happened to pick. We had a test on March 6th where we used 20 pounds of oil per ton of the total feed, and our middlings contained 47.29 pounds. If you want to take time for me to look through my record I can pick out that day. Here is another case where we used 20 pounds, and we got 42 pounds per ton for the middlings.

X Q. 192½. That 60 pounds was rather an exaggeration, wasn't it, or a slip?

A. No; here is a case right here—I was looking over my record last night—where we used 24 pounds, and we got 64 pounds in the middlings.

X Q. 193. Let me look at those figures—Now the entry that you have shown me reads "Pounds of Oil in Circulation, 4,434, or
2583 64.26 pounds per ton of circulating feed." What is the basis of that determination?

A. We take tonnage samples to determine what our circulating feed amounts to, and in this particular case it amounted to 69 tons. We analyzed that and found that it contained 64.26 pounds per ton of that feed. 64.26 multiplied by 69 should give 4,434.

X Q. 194. And what was the total—then it is a calculation, isn't it, of the total amount of material flowing into that circulating feed?

A. Certainly. We could not take the whole 69 tons and determine the amount of oil in it. We would have to rely on our analysis for that.

X Q. 195. What happened to that 64.24 pounds per ton?

A. It went down through our return plant and back to the Dorr tanks.

X Q. 196. And then what happened to it?

A. Then went through the flotation machine.

X Q. 197. Were you building up all the time in that flotation machine an added increment of oil from that circulating feed?

A. The way we operated our plant, we take what concentrates look clean enough, and would send that directly to the smelter or to the bins rather and the concentrate coming off the balance of the machine we considered middlings, and that constituted our circulating feed.

X Q. 198. Well, if you were returning such an amount of oil you would be building up in your machine a great quantity of oil, wouldn't you?

2584 A. Not necessarily, because about the second time the oil goes through the machine it would be going out in the form of a concentrate or with the tailings.

X Q. 199. And this would be just something that happened at a certain minute and could not be maintained?

A. No, sir, that would become constant. The tonnage samples were taken every half hour and a composite sample was taken from that sample for the twenty-four hours.

X Q. 200. Now, what figures have you there that show where that oil went to after it went through that machine?

A. I have no figures in this particular case. It must have gone out in the tailings or in the concentrate.

X Q. 201. When was this experiment performed?

A. That was not an experiment; that was an actual operation.

X Q. 202. When was it done?

A. In March, 1917.

X Q. 203. Of what year?

A. Of 1917.

X Q. 204. What were the oils that you were using or the mixture of oils?

A. A combination of smelter fuel oil and American creosote combined in proportion of 90 per cent smelter fuel and 10 per cent American creosote No. 2.

X Q. 205. You might read the description of the flow sheet in the record; read it.

A. During that day seven cells, the concentrates from seven
2585 cells was sent to the bins and the products from 21 cells were in circulation. The tailings were sent to waste. Now speaking of 7 cells and 21 cells, that is the total number of cells in both of our plants. One machine has 13 cells, and the other has 15, making a total of 28 cells.

X Q. 206. What machine was this in?

A. This is the composite result from both machines—this is treating low grade concentrate.

X Q. 207. The same natural division between the two machines and an average of what was going on in the two machines; is that it?

A. Yes, sir.

X Q. 208. I ask you to read into the record the description of that day's proceeding—or, if counsel will consent—the stenographer can copy it into the record and then give it back to you.

Mr. Williams: We will ask the stenographer to copy both days as they appear on the sheet.

The sheet above referred to, which was used by both counsel and the witness is as follows:

March 13.	Toppage.	Cu.	Fe.	Insol.
Heading	414.0	4.900	6.97	77.07
Tailing	315.0	.248	.....	.....
Concentrate	99.0	19.685	25.36	17.36
Per Cent. Indicated Extraction	.....	.....	.....	96.15
Ratio of Concentration	.....	.....	.....	4.18
Per Cent. Solids in Feed	.....	.....	.....	29.56
Total Tonnage New Feed	.....	.....	414	.....
Total Tonnage Circulating Feed	.....	.....	69	.....
Total Tonnage Feed Entering Machine	.....	.....	483	.....

Oils and Reagents Used:

Pounds New Oil Added	7,186. or 17.36 lbs. per ton New Feed
Pounds Oil in Circulation	4,434, or 64.26 lbs. per ton Circ. Feed
Lbs. Oil Required for Circ. Tonnage	1,380, or 20.00 lbs. per ton Circ. Feed
Pounds Circ. Oil used as New Oil	3,054, or 7.37 lbs. per ton New Feed
Total lbs. Oil used as New Oil	10,240, or 24.73 lbs. per ton New Feed
Pounds Calura Reagents Used	3,266, or 7.89 lbs. per ton New Feed

Oil Combinations: 90% Smelter Fuel, 10% American Creosote No. 2.
Flow Sheet: 7 cells to bins; 21 cells to circulation, tailing to waste.
No. 1 machine down 6′ 35″, No. 2 machine down 5′ 05″ due to broken table line shaft in Retreatment Plant.

THIS PAGE BOUND

March 14.	Toppage.	Cu.	Fe.	Insol.
Heading	666.0	5.450	7.33	78.33
Tailing	519.0	.315	.....	.....
Concentrate	147.0	23.585	23.42	18.82
Per Cent. Indicated Extraction	.....	.....	.....	95.50
Ratio of Concentration	.....	.....	.....	4.53
Per Cent. Solids in Feed	.....	.....	.....	32.12
Total Tonnage New Feed	.....	.....	666	.....
Total Tonnage Circulating Feed	.....	.....	68	.....
Total Tonnage Feed Entering Machine	.....	.....	734	.....

Oils and Reagents Used:

Pounds New Oil Added	10,467, or 15.72 lbs. per ton New Feed
Pounds Oil in Circulation	4,250, or 62.50 lbs. per ton Circ. Feed
Pounds Oil Required for Circulating Tonnage	1,360, or 20.00 lbs. per ton Circ. Feed
Pounds Circ. Oil used as New Oil	2,890, or 4.34 lbs. per ton New Feed
Total Pounds Oil Used as New Oil	13,357, or 20.06 " " " " "
Pounds Calura Reagents Used	3,985, or 5.98 lbs. per ton New Feed

Oil Combinations: 90% Smelter Fuel, 10% American Creosote No. 2.
Flow Sheet: 8 cells to bins, 21 cells to circulation, tailing to-waste.

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2587 X Q. 209. These machines in all of these plants you have described are known as Janney machines, are they not?

A. They are.

X Q. 210. You are the inventor of these machines, are you not?

A. Yes, sir.

X Q. 211. I now show you patent No. 1,167,076 to Thomas A. Janney, patented January 4, 1916, for ore concentrating apparatus, application filed August 10, 1914. You are the Thomas A. Janney to whom that patent was issued?

A. Yes, sir.

X Q. 212. I now show you patent No. 1,201,053 patented on October 10th, 1916, to Thomas A. Janney, for ore concentrating apparatus, application filed April 23rd, 1914. Are you the Thomas A. Janney to whom that patent was issued?

A. I am.

Mr. Williams: I offer these patents in evidence.

Mr. Kremer: I object to them for the reason that they are incompetent, irrelevant and immaterial for any purpose unless it is to show a picture or cut of the apparatus. The contents of the patent has nothing to do with the matter in issue. A photograph of the machine might be admissible.

Mr. Williams: I would like to state the purpose.

The Court: What purpose, other, will that serve, Mr. Williams? What have you in mind?

2588 Mr. Williams: They serve the very important purpose of showing that all of these operations that have been described at such length by this witness and are said to represent the prior art have been carried on in a modern machine invented by Mr. Janney long after the art of flotation concentration became a part of the knowledge of the world by reason of the patent in suit.

Mr. Kremer: There has been no proof that that was the cause of the result. The cause of the result, as the witness has testified, is the use of a certain oil upon a certain ore, and was not the method in which the work was carried on. I started to say, "experiment" but it was not an experiment it was an operation. It has nothing on earth to do with it.

The Court: That is your claim. Now they have a right to make their claim.

Mr. Kremer: If they desire to introduce that as a part of their defense, we will admit it.

The Court: They have a right to offer it on cross examination. The objection will be overruled.

Mr. Kremer: Exception.

Patents admitted in evidence and marked Plaintiff's Exhibits 33 and 34.

Mr. Williams:

X Q. 213. Generally, the first of these patents, #1,167,076, is for the large sized commercial machine, as you made it originally, is that right?

A. Yes, sir.

X Q. 214. And the second issued patent——

2589 A. That was the first patent.

X Q. 215. No. 1,201,053 on which the application was first filed?

A. Yes, sir.

X Q. 216. That is your test machine, is it not?

A. Yes, sir.

X Q. 217. Now, generally, when did you first put at work in a practical operation, the machine of the large size shown in your first issue of patent, generally; about when?

A. I think it was in July of 1914—or I think it was in the early part of 1914.

X Q. 218. The early part of the year 1914?

A. Yes, sir.

X Q. 219. And as to your other patent on which the application was first filed, when did you get that apparatus first working?

A. That was in the latter part of 1913.

X Q. 220. Then, there is another type of machine which has been testified about, your machine with a pneumatic arrangement, compressed air going through a porous medium in the Spitzkasten, that I take it is a later product, isn't it, later improvement?

A. I developed that machine, I think it was in the year—put it in actual operation in the latter part of 1914 in a sort of an experimental way. We put it in actual operation at the Chino Copper Company the first time, if I remember right, for large scale operations, I believe it was in June or July of 1915.

2590 X Q. 221. That was just after the Wilmington trial, was it not?

A. Yes, sir.

X Q. 222. You haven't any earlier patent on machines, flotation machines, than those two that have been put in evidence, have you?

A. No, I have not.

X Q. 223. In fact, you never invented—you haven't any other in actual issue of patents, have you?

A. No, sir.

X Q. 224. And these patents are your first inventions in flotation machines?

A. They are.

X Q. 225. Now, in respect to the experiments in defendant's exhibit 31, series of results obtained from commercial experiments on low grade concentrates, you testified to given dates when the experiments were carried on, and you gave only one or two. I will ask you to state them in series?

A. Experiment No. 1 was made on the day shift of March 30th, 1917. No. 2 on March 29th. That ran twenty-four hours. Experiment No. 3 was on the 28th of March. No. 4 was on the 27th. No. 5 on the 26th. No. 6 was on the 25th. No. 7 was on the 28th. No. 8 was on the afternoon and night shift of March 30th. Experiment No. 9 was made on April 1st, 1917. Experiment No. 10 was made on March 31st, on the afternoon and night shift. No. 11 was

run on April 2nd. No. 12 was on April 14th. No. 13 on
2591 April 3rd. No. 14 on April 6th. No. 15 on April 5th. No. 16 on April 5th—I am not sure. I will have to look it up to see whether it was on the day shift or the afternoon. And No. 17 was on the day shift of April 5th. No. 18 was on the afternoon shift of April 8th, and No. 19 was also on the afternoon shift of April 8th.

X Q. 226. They were successive experiments—any space in between?

A. No, sir.

X Q. 227. Couldn't have been?

A. No, sir.

X Q. 228. Now, No. 20?

A. No. 20 was on April 7th.

X Q. 229. 1917?

A. 1917, yes, sir.

X Q. 230. How many experiments of the character of those described on April 7, No. 20, of the same general character, that is using those oils, sixty per cent. smelter fuel and forty per cent. Jones oil, did you carry on?

A. Why, at the Arthur plant that is all we carried on, but at the Magna plant they carried it on for several days I believe.

X Q. 231. You have not made any showing of this experiment on the—what is it, the Magna plant?

A. Magna plant. No, just testifying to the Arthur plant results. That is all this tabulation covers.

X Q. 232. Now, I note that on exhibit 31 your circulating
2592 oil is undetermined or was not given under experiments 14, 15, 16 and 17. Why is that?

A. On those days we, unfortunately, got mixed up in the samples that were taken. My instructions were not carried out and I did not know it until several days after the test was made.

X Q. 233. Your samples got mixed so that you could not be sure of the results?

A. The boy did not take the right samples.

X Q. 234. Now, in taking the circulating oil samples for experiments 18 and 19, how did you make your computation for those soluble constituents of the oils that had gone into solution?

A. The way we determined the amount of oil in these samples was this way: A sample was taken in the wet shape and was dried over a steam bath, and we tried not to dry off—and we tried not to drive off any of the lighter oils, and as far as our knowledge goes none of the oils were driven off by the steam bath, as the temperature couldn't very well get over 100 degrees C. A portion of the sample was then taken and placed in a flask that had previously been weighed. We added to this sample some petroleum ether and placed a stopper or cork in the flask with the stem of the reflux—that——

X Q. 235. That is to say, an apparatus in which the material is evaporated and goes up and then condenses and goes back to where it started from?

A. Yes, sir. This flask was placed on a hot plate and allowed to boil for some time until we thought all the oil was in solu-

2593 tion. Then we took that sample and decanted all of the filtrate off and then rewashed the sample until we were sure that all of the oil had been extracted and was filtered. We then took the filtrate and placed it under another condenser and then we drove off all of the petroleum ether by means of the heat derived from a steam bath. That is, we tried to keep our temperature under 100° C. And we continued heating at this temperature until all of the petroleum ether had been driven off. The flask was again weighed and the difference in the weights was considered the amount of oil in the sample. We went through the same routine on that same sample with benzol. We did that because we found that petroleum ether would not dissolve the coal tar oils, and then later we washed it again with alcohol in the same manner; and the sum of the residues from each determination was added together to determine the total oil.

X Q. 236. Well, your American creosote No. 2 contained something else besides oil, didn't it?

A. Not to my knowledge. It contains napthalene, is all, a little fraction of coal tar.

X Q. 237. How about phenols?

A. I presume there are some phenols in it.

X Q. 238. Isn't there usually a large proportion of phenols, a very substantial proportion of them in creosote? Can't you tell me about this creosote, what proportion of phenol and what proportion of oils, insoluble?

2594 A. We do not determine them as phenols. We determine our oils as tar acids. Now, I am not chemist enough to know just what those tar acids are.

X Q. 239. Well, give me your determination?

A. Tar acid value of the American Creosote No. 2 was 4.4 per cent.

X Q. 240. Now, did you make any determination of the solubility or soluble parts in the proportion used?

A. No, we have not.

X Q. 241. As a matter of fact, you know that phenol and cresol are soluble frothing agents?

A. I have heard they are.

X Q. 242. Have you ever tried them?

A. No, sir; not in a pure state I haven't.

X Q. 243. Don't you know whether they are or not?

A. I saw you people use them in Wilmington, in the Wilmington case.

X Q. 244. Well, you saw us use them then?

A. Yes.

X Q. 245. As soluble frothing agents and producing froth in that trial, didn't you?

A. Yes, sir.

X Q. 246. Now, as to these soluble frothing agents that were present in that American creosote why, your determination does not tell us anything about that, what became of that, what proportion of that appeared in the circulating load?

2595 A. We didn't make our determination to try to find out what particular oils were returned in the middlings. We were just trying to find how much oil, regardless of the kind.

X Q. 247. Well, these would not come within your determination of oils, would they, these substances, phenol and cresol?

A. I don't think they would evaporate with the water. I think the boiling point of phenol and cresol is a little lighter than that of water.

X Q. 248. Well, but did you take a great bulk specimen of the water so that you would keep all the phenol and cresol that was circulating in it?

A. Yes, sir, that was taken in a bucket so we would get everything.

X Q. 249. So you rather think the phenol and cresol in your operations were determined in weighing oils?

A. I do.

X Q. 250. Now, in your plant how did you handle the water, did you use it over again?

A. Not the water that has been through our flotation plant, we don't.

X Q. 251. The water that goes off with the tailings of the flotation plant, does that ever get back again?

A. Well, I presume it does. It goes out in a large field. I don't know how large it is, but it looks to me like it was a couple of miles square—and the water is returned, or a portion of it is returned.

2596 X Q. 252. Well, then, you do use the same water over again?

A. Not at our plant. It goes to both plants. We have one central pumping station.

X Q. 253. Well then, the water from the two plants goes to this great lake or pond and there you settle out the solids and then that is pumped back and used over again, is that right?

A. Yes, sir, but the amount of oil in proportion to the amount of water we use at both plants, I doubt very much whether you could find a trace of oil in the water.

X Q. 254. That is to say there is so much water that comes from the plant that has not been through the flotation plant, is that the reason?

A. Yes, sir.

X Q. 255. So that even now, with these large quantities of oil, you think there would not be a trace of oil worth speaking of in the water?

A. I doubt whether a chemical analysis would detect it.

X Q. 256. You never have made any determinations?

A. No, sir. We treat in both plants between thirty and forty thousand tons of ore a day, and for every ton of ore that goes through the plant we use one gallon per minute per ton of ore per day, so that would be 1440 gallons per ton of ore per day. 1440 times 40,000 would make quite a bit of water.

X Q. 257. In your table, defendants' exhibit 31, you have
2597 "reagents, total pounds" in one column and "pounds per ton" in another column. What are those reagents?

A. It is an alkaline reagent.

X Q. 258. Such as?

A. I can tell you just exactly what Dr. Ebaugh, chemist of the University of Utah says it is. It is made by boiling a mixture of lime, sulphur and caustic soda together, and Dr. Ebaugh says that—mixtures—that it forms a compound of no one definite mixture, but is composed of calcium, thiosulphate, calcium sulphide or polysulphide in solution and also sodium sulphide and the thiosulphates.

X Q. 259. Do you use that most of the time?

A. Yes, sir, we used that entirely in the treatment of our low grade concentrates.

X Q. 260. And that is the whole of the "other reagents"?

A. Yes, sir. At times we have used as a frothing agent a mixture of sodium sulphide and rosin.

X Q. 261. And would that be in other reagents? Would that be in the "other reagents" column?

A. No, we didn't use that during these tests.

X Q. 262. So that in these tests, you used these—you used this peculiar substance that was made out of——

A. Yes, sir.

(Whereupon a short recess was taken.)

X Q. 263. I think you want to make a little correction.

2598 A. Before recess I mentioned that Dr. Ebaugh was at the University of Utah, but I think now he is doing private consulting work in Salt Lake City.

X Q. 264. Now, let us take experiment No. 1 on defendant's exhibit 31. The amount of the oil that was fed into the machine was 1.6 pounds to the ton of solids in the feed. Is that right?

A. 1.6 pounds of oil for every ton that went into the machine.

X Q. 265. That is, you fed into the machine 1.6 pounds of oil for every ton of solids that was fed into the machine at the entrance end?

A. Yes, sir.

X Q. 266. And then this next figure, 1.39 pounds per ton, that is figured on what?

A. On the original feed, plus the circulating feed.

X Q. 267. That would be the total amount of solids going through the machine from what point to what point?

A. From the emulsifier to the last cell.

X Q. 268. And how many cells?

A. In one machine we have 13 and in the other one we have 15.

X Q. 269. And how many emulsifiers?

A. Two emulsifiers at the head of each machine.

X Q. 270. Then under the heading, "Total new and circulating oil," we have per ton of new feed, 7.91 pounds. How do you determine that?

A. That is determined by multiplying the 151 tons times 1.6; that would give you the total oil added to the machine. Then

2599 our circulating tonnage was 23 tons, and that was multiplied by the analysis—that is, the amount of oil determined by analysis, in that circulating feed, by the circulating tonnage.

X Q. 271. How was that determined.

A. That was determined just like I mentioned before recess.

X Q. 272. From the total material, water and solids, or liquid and solids which was moving back in that circulating feed?

A. Yes.

X Q. 273. Now, what was the proportion of oil on the concentrates that were delivered by that plant in that experiment?

A. I haven't that figure.

X Q. 274. Was it measured?

A. Not the oil in the concentrate, no.

X Q. 275. Did you measure the amount of oil in the tailings?

A. No, sir.

X Q. 276. Then apparently with a feed of 1.6 pounds of oil to the ton of feed, you jumped in the plant to 6.87 pounds to the ton of solids flowing through the plant. Is that right?

A. Yes, to 6.87 pounds.

X Q. 277. Do you regard the determination that you made of that as a reliable calculation?

A. Yes, sir.

X Q. 278. But you can not tell us where that oil went to afterwards?

2600 A. No, I can not.

X Q. 279. At what time during the operation was that measurement taken?

A. That figure was calculated from a composite sample made up of samples taken every half hour during the day.

X Q. 280. During the 8 hour run?

A. Yes, sir.

X Q. 281. Did you make up a composite sample before you measured—Did you measure the individuals of that composite?

A. No, sir. We had a cutter—I think it had a half inch opening in it, and we passed it across the stream, and we would take the contents collected and put them in a bucket and let them accumulate for 8 hours.

X Q. 282. Now, I was not able to understand your description of these plants. Have you any flow sheet or drawing that would help us to understand?

A. No, I have not.

X Q. 283. You could supply a drawing that would represent the condition of these plants, couldn't you, by way of a general diagram, so as to make your description clear?

A. If you will get permission from Mr. R. C. Gemmell, the manager, of the plant, I will be glad to do so.

X Q. 284. But you have described it?

A. Yes.

X Q. 285. I would like to have you describe it by a picture.

2601 A. I haven't that authority.

X Q. 286. Are you willing to draw the picture?

A. With permission from Mr. Gemmell, I am.

X Q. 287. Did you get his permission to describe the plant in your testimony?

A. No, but I have received instructions that I am not to give out any flow sheets of our plant. If I drew you a plan of the mill, I would be disobeying my instructions.

X Q. 288. I don't want the mill, I want the flotation plant that you have particularly described.

A. I think I can get that authority, to draw you that.

Mr. Scott: Do you simply want a diagram of the flotation cells and the direction in which the pulp flows and where the middlings are returned and where some of it goes to the cleaner, or what?

Mr. Williams: Just a pictorial representation of each of these plants so we can have a concrete representation of the plant.

By Mr. Scott:

X Q. 289. Is there any objection to making a sketch of the flotation cells with arrows showing which way the pulp flows, Mr. Janney?

A. I think not.

By Mr. Williams:

X Q. 290. Well, make that sketch of both plants, and then we can understand one from the other, just of these flotation plants; of course you have no such drawing now?

A. No, I haven't.

X Q. 291. Now, will you supply specimens of the oils that you have described?

2602 A. I will.

X Q. 292. And also a specimen of your ore, reduced to quarter inch size?

A. I cannot give you a representative sample of our ore, because our mines cover some 720 acres of ground, and the steam shovels may be working in one part today and another part tomorrow. I can get you a sample, but I don't know that it would be representative of our ore.

X Q. 293. Couldn't you get a sample representative of what you used in the experiment that you have described?

A. I can give you samples of our slime feed, but that is ground pretty fine.

X Q. 294. You have those with you, haven't you?

A. I have some of that pulp with me, yes.

X Q. 295. Well, let us have samples of your slime feed, and then try and procure from the mine a specimen as near as possible to what you used in your experiments, dry crushed to quarter inch size. Will you do that?

A. I will do that. Now, in giving you these oils, I don't know that I can give you the exact oil. When I left the plant the sample I took was taken from a tank containing some 14 or 15 thousand gallons of pine oil, and since then some oil has been put into it, and it may not be an exact duplication of the oil that I used. That

holds true with respect to all other oils. I will give you what the manufacturers furnish as American creosote and Yaryan pine and so on.

2603 X Q. 296. That is to say, if the manufacturers have varied the grade since you did these experiments, you won't be responsible for it; is that the idea?

A. That is the idea.

X Q. 297. Well, that will do for that. Now, I don't know that I quite clearly understood—When you were making your oil determinations did you de-water your sample?

A. I did not; water and oil were taken down to dryness over a steam bath.

X Q. 298. So that it was a determination of the whole amount of the material that was flowing?

A. Yes, sir.

X Q. 299. Did you make any examination of the petrolic ether and the benzol that you used for the purpose of determining whether there was any non-volatile matter in that?

A. We purchased our petrolic ether and benzol from the Mine & Smelter Supply Co., of Salt Lake City, and they were purchased as chemically pure products.

X Q. 300. After exhibit 31, on your exhibit 32 I see that there is no experiment corresponding to the last experiment on Exhibit 31. Why didn't you make that——

A. I don't quite understand you.

X Q. 301. In exhibit 31 your last experiment was one in which you used those oils, smelter fuel and Jones oil alone, without any of the oils that you called frothing oils. In exhibit 32 there is no such experiment described; that is to say, you do not sepa-

2604 rately take your paraffine distillate and Gilsonite and see what they would do alone. Did you make that experiment?

A. I have done it in the laboratory, but not in actual practice. I was pressed for time, and I did not have time to do that. It was fair to assume that if the creosote and Yaryan pine would not do it, but the mixture together would, that the Gilsonite mixture was evidently playing a very important part.

X Q. 302. But you have not tried it on a large scale, and you don't know what would happen on a large scale as a basis of trial?

A. No, I do not.

X Q. 303. When you described the material which you called slime feed, you said 75% would go through a 200-mesh screen, and you did not supply any other particulars of the screen analysis. Can you do so, and if so, will you?

A. Yes, I have a screen analysis here which I think is fairly representative. This screen analysis was taken for the month of January, 1917, of our flotation heading.

X Q. 304. Just give it.

A. .12 of 1% of this material passed through a 28-mesh screen and remained on a 35-mesh screen. .5% passed through a 35-mesh screen and remained on a 48-mesh screen. .157% passed through a 48-mesh screen and remained on a 65-mesh screen. 5.94 passed

through a 65-mesh and remained on a 100-mesh. 8.79
2605 passed through a 100-mesh and remained on a 150-mesh. 7.63% passed through a 150-mesh and remained on a 200-mesh. 75.46% passed through a 200-mesh screen.

X Q. 305. Now, give me the screen analysis of the low grade concentrate which you used.

A. .05 of 1% of this material passed through a 28-mesh screen and remained on a 35-mesh. .27 of 1% passed through a 35-mesh and remained on a 48-mesh. 1.97 passed through a 48-mesh and remained on a 65-mesh. 12.09% passed through a 65-mesh and remained on a 100-mesh. 21.93 passed through a hundred mesh and remained on a 150-mesh. 27.33 passed through a 150 mesh and remained on a 200-mesh screen. 36.36% passed through a 200-mesh screen.

X Q. 306. And these screens were of what standard?

A. They were Tyler's Standard screen, in which the ratio of openings was 1.414. You can have these screens if you want them. There is one screen there that I have not testified to.

X Q. 307. What one is that?

A. The concentrates.

X Q. 308. Give the screen analysis as you have of the other material.

A. This screen analysis that I have now is the concentrate produced from our slime plant. .08 of 1% passed through a
2606 35-mesh screen and remained on a 48-mesh. .25% passed through a 48-mesh and remained on a 65-mesh. 1.57 passed through a 65 and remained on a 100-mesh. 4.20 passed through a 100 and remained on a 150-mesh. 4.61 passed through 150-mesh and remained on a 200-mesh. 89.29% passed through a 200-mesh.

By Mr. Scott:

X Q. 309. Is that the concentrates from the slime flotation treatment?

A. Yes, sir.

By Mr. Williams:

X Q. 310. What is this Gilsonite oil that you have mentioned?

A. Gilsonite itself is in a solid form. It is solid, hydro-carbon, which comes from the Uinta Valley in the northern part of Utah, I believe.

X Q. 311. And it is the material as it is dug up out of the ground?

A. Yes.

X Q. 312. What is its general nature?

A. It looks in appearance like asphaltum. This sample of Gilsonite that I analyzed or had analyzed, rather, was black in appearance, with a metallic lustre, very fragile. I subjected it to a distillation test and found that it contained 56.58% of oil by weight. The oil obtained from this distillation had a gravity of .8704. The color was deep red, and it becomes dark upon standing. The odor was very disagreeable; it had an odor of decomposition, with no

sediment present, and very slightly viscous. The analysis showed that all the oil was distilled off at 350 degrees centigrade.

2607 X Q. 313. What was the other material besides oil?

A. I don't know. After we distilled off all the oil, the residue looked like coke.

X Q. 314. And it was distilled at what temperature?

A. The report shows that the maximum temperature was 350 degrees centigrade.

X Q. 315. You would call the material tar, wouldn't you, that you had left after the distillation—the solid material that was mixed with the oil?

A. The cinder—it could not be like tar, because I said it was fragile, while tar is soft.

X Q. 316. Was heat used in any of this work that you have described in the tables that have been put in evidence?

A. You mean the tables of the experiments?

X Q. 317. Well, we will take first the experiments; was any heat used?

A. No.

X Q. 318. Now, as to the operations extending over the period that you have knowledge of, was heat used at times or all the time?

A. Which table are you referring to?

X Q. 319. Exhibit No. 30.

A. I haven't got these marked, so will you kindly read the heading?

X Q. 320. "The Utah Copper Company, Arthur plant, February 1st, 1915, to April 8th, 1917." Now, confine the question to

2608 what was done when you were there, in 1916, was heat used at any time, and if so, at what time?

A. I was at the plant in February 1915, and previous to that time, in the latter part of 1914, we had tried heat, but it did not help.

X Q. 321. Why are those operations given as commencing in February, 1915?

A. That is when we actually started to operate flotation at the Arthur plant.

X Q. 322. What was done with the material which this plant received before—with the material of the grade and character that this plant received, before this flotation plant was installed?

A. We shipped it to the smelter as a low grade concentrate.

X Q. 323. Mixing it in with a high grade concentrate, I suppose?

A. We took part of it and mixed it in with the high grade concentrates. Our smelter contract is such that we are penalized if our insoluble exceeds our iron, and the concentrates as made by our finishing table, generally contained a higher percentage of iron than insoluble, and we would mix some of this low grade with it, so that the iron and insoluble would practically balance. The balance of the low grade concentrates we usually shipped to the smelter, as our high grade charge was limited to a certain figure, and we found it would be cheaper to smelt it separately than to have all of

2609 our concentrate penalized.

X Q. 324. As a result of the treatment that you gave this

material in the flotation plant, what happened in general as to the value?

A. It increased the value of it.

X Q. 325. Very materially, did it not?

A. Yes. We would not be doing it if it did not.

X Q. 326. Well, as far as your knowledge goes, after having tried the result of heat before these operations were started, heat was not used during these operations, is that right?

A. Yes.

X Q. 327. And I presume sometimes your water is pretty cold?

A. It gets very cold in the winter time.

X Q. 328. What did you do with the slimes before you adopted flotation?

A. We treated it on vanners.

X Q. 329. The same character of slimes that are now treated by flotation?

A. Practically the same.

X Q. 330. What—with what sort of recoveries, we will say, as compared with flotation, and shorten it up.

A. If I remember correctly, we made somewhere in the neighborhood of 54 or 55% recovery on the vanners.

2610 X Q. 331. And by flotation you made what?

A. Well, we are not treating the same product.

X Q. 332. How is the product different now?

A. The product differs now inasmuch as I believe our slime now is a little finer than it used to be.

X Q. 333. And what sort of recoveries do you make?

A. Now?

X Q. 334. Well, I don't know whether you are operating now; but in general, what have you made with flotation?

A. After we discovered that sulphinated oil mentioned, our recoveries ranged up to 90%.

X Q. 335. Are you using that now, that sulphinated oil, at the present time?

A. Yes.

X Q. 336. What amount of oil are you using in that operation?

A. It is in the neighborhood of 1.4 pounds per ton.

X Q. 337. Does your ore contain any oxidized material?

A. About 2% of our copper is in the form of an oxide.

X Q. 338. Do you recover that?

A. I think not.

X Q. 339. In general, what is the nature of your ore?

A. Our ore is an altered silicious porphyry with the mineral finely disseminated throughout the mass.

X Q. 340. And a fair average of the copper content?

2611 A. The average copper content of our ore body is 1.46%.

X Q. 341. And what are the upper and lower limits of the material that you treat—that you mine and treat and mill?

A. It varies between 1 and 1.8 per cent. There have been times when the ore has been a little higher than that, but it won't average that.

X Q. 342. In exhibit No. 30, there are no weights of the dry product as I understand it; why is that—that is, the Utah Copper Company, Arthur plant, operations from February 1st, 1915, to April 8th, 1917?

A. Probably when I asked for those tabulations I had no reason for asking for the tonnage of concentrates produced. That tonnage can easily be calculated, though.

X Q. 343. Make a calculation of that, please and be ready to give it to me later on.

A. Of the total, or for each month separately?

X Q. 344. Each month.

Mr. Scott: A tabulation of that, if it can be simply calculated, why should the witness be called upon to do it? It shows on the face of the table.

X Q. 345. Can that calculation be made from the material that is given in this table without any additional material whatsoever?

A. Absolutely.

X Q. 346. I think we would like to have your calculations because it is a necessary supplement to the information that your table gives?

2612 A. If Mr. Scott has no objection I will.

Mr. Scott: I have no objection, if you want to be a calculator for Mr. Williams.

Mr. Williams:

X Q. 346½. One other point about sulphuric acid. In any of these operations was sulphuric acid used?

A. In our slime plant.

X Q. 347. In your slime plant?

A. Yes, sir.

X Q. 348. Does that show in the table?

A. Yes, sir, I think it does. Yes, it shows when it was used.

Mr. Williams: I believe Judge Garrison would like to ask a question.

Mr. Garrison: With your honor's permission, I would like to clear up one matter, that is in doubt in my mind.

Cross-examination.

By Mr. Garrison:

X Q. 349. Won't you take this sheet which has been admitted in evidence and marked defendant's exhibit 31—would you rather use your own—refer to the first experiment. The sheet shows that there were 151 dry tons, does it not?

A. Yes, sir.

X Q. 350. And it shows that you used 1.60 oil per ton?

A. Yes, sir.

2613 X Q. 351. Which makes a total of 242 total pounds of oil used?

A. Yes, that is new oil used per ton.

X Q. 352. No, no, answer my question just as I put it. (Read the question please.)

A. That is what I am trying to explain to you.

Mr. Garrison: Just say I am wrong if I am wrong. Just read the question please.

A. No.

Mr. Garrison: Read the question please.

(Question read as follows: "Which makes a total of 242 total pounds of oil used?")

X Q. 353. You say you took 151 dry tons, is that correct?

A. Yes.

X Q. 354. And to that you put in the plant 1.60 pounds of oil?

A. Yes.

X Q. 355. That makes a total of 242, does it not?

A. It should make it.

X Q. 356. Well, does it ?

A. I haven't checked up the figures. I don't know.

X Q. 357. All right, then, take a pencil and check it. It doesn't make it quite; it makes 241.50. I am not going to trip you on that.

A. Well, if it was 241.50 we drop the five and call it 242.

X Q. 358. It is 241.60 as a matter of fact. I am caring nothing about that. Now, did you at any time in that day's operation add any more oil than 1.60 per ton, reckoned on 151 tons?

2614 A. At any one minute or any one hour?

X Q. 359. Read my question please.

(Question read as follows: "Now, did you at any time in that day's operation add any more oil than 1.60 per ton, reckoned on 151 tons?")

Mr. Garrison:

X Q. 359½. Isn't that question plain?

A. I can't answer that accurately.

X Q. 360. Why not?

A. Because I do not know the rate of flow through the machine; it might have varied from hour to hour.

X Q. 361. I am not asking you that, sir, I am asking you in the whole eight-hour run did you ever add to that 151 tons more than 1.60 pounds of oil?

A. Not of new oil.

X Q. 362. Then there never could be in that plant on that day by reason of anything that you did any more than 1.60 times 151, could there?

A. Yes.

X Q. 363. How would it get in there?

A. It would come back in the form of middlings.

X Q. 364. But, my dear man, if you only put 241——

Mr. Kremer: Let the witness answer the question.

Mr. Garrison: I am not quibbling with him.

Mr. Kremer: We waived the formality of one counsel cross-examining, without any question.

The Court: He is puzzled; he wants to clear it up.

Mr. Kremer: Counsel should not be puzzled.

2615 Mr. Garrison: The court has said that I may continue. I have no desire to argue with him.

X Q. 365. Now, Mr. Witness, if you never put, during that whole—more than 241 pounds or 242 pounds—let's take your own figures—of oil into the plant how did any more oil than that get in the plant?

A. Why, it could stay in there and keep in circulation.

X Q. 366. Why, certainly it could. But how could any more than 242 pounds circulate?

A. I don't think more than 242 pounds was circulating.

X Q. 367. Precisely. Then there was never more than 242 pounds of oil in that plant during this eight hours, was there?

A. Why, sure there was, the new oil plus the amount of oil circulating.

X Q. 368. But if you never put more than 242 pounds in that how could more than 242 pounds circulate?

A. Because we are not rejecting the 1.6 pounds of oil in the tailings.

X Q. 369. I don't care what you are rejecting and what you are keeping. If you didn't put more than 242 pounds in oil in your tank how could any more than that circulate, by circulation, rejection or any other thing.

The Court: Probably the witness does not understand you.

2616 Mr. Garrison: Will your honor put it to him so he can understand it. I don't want to argue it with him.

The Court:

X Q. 370. You think there is other oil than this 242 pounds, as I understand it?

Mr. Garrison:

X Q. 371. You had 151 tons total of dry ore, didn't you?

A. Yes, sir.

X Q. 372. And you applied to that 1.60 of oil, didn't you, during the whole eight hours?

A. Yes.

X Q. 373. And you never put any more oil in than 1.60 times 151, did you?

A. No, sir.

X Q. 374. Well, then, the total amount of oil that ever got in that plant that day was 242 pounds, wasn't it?

A. Yes, sir.

X Q. 375. Now then, how was it possible then for any more oil to circulate or be in there than 242 pounds?

A. There must have been more oil in circulation when we started this test.

X Q. 376. Well, then, this whole table is perfectly illusionary and useless, isn't it?

A. No, because I show the total amount of oil that went through the machine.

X Q. 377. But the total amount of oil that went to the machine according to this table is 1.60 on 151 tons, isn't it?

A. No, I said there was some oil in circulation before that was put into it.

2617 X Q. 378. Well, then, this sheet is entirely illusionary?

A. I didn't say we only used 1.60 pounds to the ton. I say we used 6.87.

X Q. 379. Isn't the whole purpose of this table to show the amount of oil you were using per ton?

A. Yes, sir.

X Q. 380. Now, you said on one day when you used 151 you take your plant to make a test——

A. Yes, sir.

X Q. 381. (Continuing:) —and you ran your plant eight hours to make a test, didn't you?

A. Yes, sir.

X Q. 382. And you put into your mill 151 tons, didn't you?

A. Yes, sir.

X Q. 383. You said you added 1.60 oil to that, didn't you?

A. Yes, sir.

X Q. 384. Then, naturally, you had 242 pounds of oil in your machine as a result of that, didn't you?

A. Yes, sir.

X Q. 385. Now if there were other facts that you did not put down on this sheet before you began that whole experiment is illusionary, is it not?

A. No, sir.

X Q. 386. I wish you would explain that to me?

A. Our feed, as it is taken from the classifier goes to the Dorr thickener and that feed includes our circulation—and I don't know what the cubical contents of those Dorr tanks are, but I feel sure that they are large enough so that if you would analyze all the water and pulp contained in those Dorr tanks at the time you would get more than the total oils shown here, which is 1,195 pounds.

2618 X Q. 387. Although you put only 242 pounds of oil in during that entire experiment, in some way or other 1,195 pounds got into that machine?

A. Well, that is probably what was in the Dorr tank.

X Q. 388. Then the experiment is entirely illusionary so far as demonstrating anything about putting in 1.60 of oil in 151 tons of ore, isn't it?

A. There were 6.87 pounds of oil in it when it entered the machine.

Mr. Garrison: I insist on an answer to the question. Read the question.

(Question read as follows: "Then the experiment is entirely illusionary so far as demonstrating anything about putting in 1.60 of oil in 151 tons of ore, isn't it?")

A. I do not agree with you.

X Q. 389. Well, but it is an entirely illusionary factor isn't it, that you don't know anything about?

A. I know that there is oil in circulation.

X Q. 390. Do you know how much?

A. No, I don't. I cannot tell until after the test is completed.

X Q. 391. Why not? Why couldn't you have told at the beginning of the test if you could have told at the end of the test or any period in the test?

Mr. Kremer: Let the witness answer.

Mr. Garrison: All right.

A. I couldn't determine how much oil was in the machine until after the run was over, because as I said before our samples were taken every half hour until the test was completed.

2619 X Q. 392. I understood you to say a while ago that you did not doubt that if you analyzed the water in circulation in your mill it would be found that it contained the percentage of oil that you put your finger on, something over six pounds to the ton, or some other figure. Is that correct or not?

A. You are talking about one thing, and I am talking about another. You are talking our flotation plant now?

X Q. 393. Yes.

A. And when I made that remark before we were talking about our mill proper and these machines?

X Q. 394. Are these mixed up with these exhibits you have made, or can we confine ourselves to this one sheet without mixing them up with something else?

A. If you talk about the same thing I do.

The Court: If there is any doubt about these things you are talking about you may ask questions that pertain to that sheet.

Mr. Garrison: Wasn't the purpose of this first experiment to demonstrate according to your operations what the result was of milling 151 dry tons with 1.60 of oil per ton added?

A. Not exactly 1.60 pounds per ton, but a small quantity of oil. And I could not determine how much oil it was going to be because I knew that there was some oil coming back in the form of middlings.

X Q. 395. Well, now, just one moment. Do you mean some of the 1.60 coming back in the form of middling or oil coming from some other place than the one—than the 1.60?

2620 A. We did not stop the plant to clear out the Dorr tanks before that test was made, and some oil was in that feed from the day before.

X Q. 396. In the feed? Then this was not new feed?

A. No, the stuff that comes from the Dorr tank is new feed and middlings.

X Q. 397. Now, when you started with your 151 dry tons was there any other feed in the plant?

A. That 151 dry tons is new feed.

X Q. 398. Was there any other feed in the plant when you started with 151 dry tons of new feed, this particular 151 tons that you put down on this sheet?

A. Yes, sir.

X Q. 399. Well, then that is illusionary here because you mixed that, what you did with this experiment with something that was left over from some other experiment? Isn't that correct?

A. That is correct.

X Q. 400. Then this experiment—these experiments do not represent what they purport to represent, do they?

A. Yes, they do.

X Q. 401. Well, now, can you explain that?

A. I explained that our low grade concentrate goes to the retreatment plant, mechanical retreatment plant where it is classified. The overflow from that product goes to two forty-four foot Dorr tanks—

2621 forty-four feet wide and I think they are twenty feet deep, and the cubical contents of these tanks is something enormous—I don't know what it is—and it contains quite a bit of feed. And as we operate from day to day these tanks or these two tanks become contaminated or contain so much oil that is carried over from the day before. Now, when I started these tests I knew that there was some oil in the feed in the Dorr tanks. I did not know how much, and I was trying to find out what result we would get by using a small quantity of oil, and that is what I did. I used 1.6 pounds of new oil and 5.48 pounds of oil that was in the tank before the test started.

X Q. 402. You mean that was there. You don't mean that you used that?

A. That was in the tank before the test started.

X Q. 403. So that as far as this sheet is concerned, showing what came in there, or 1.60 of oil, it is utterly useless?

A. With 1.60 pounds of oil, yes.

X Q. 404. It is utterly useless?

A. Yes.

X Q. 405. And it is utterly useless as to every one of the figures as to any of the quantities or amounts under 1.60?

A. Yes, sir.

X Q. 406. Because in each instance the amount of oil you actually were operating with was entirely different from the figure appearing in the column in which the first figure is, 1.60?

A. Yes, sir.

X Q. 407. And when you made an experiment there was

2622 no way of demonstrating the verity of it unless you knew what was in the Dorr tank before you began? Isn't that correct?

A. I could not tell how much oil I was going to use until afterwards.

X Q. 408. Yes, and you could not tell about a great many other factors because of the remnants of the previous day's operations that had not been cleaned out? Isn't that true?

A. Yes.

Mr. Garrison: That is all.

Mr. Williams: Subject to the reservation as to the other witness, the cross-examination of this witness is closed.

Redirect examination.

By Mr. Scott:

R. Q. 409. Mr. Janney, referring to this column "pounds new oil added per ton new feed" the figures in that column, do they accurately represent the amount of new oil that was added for each ton of new feed?

A. They do.

R. Q. 410. And if there is any error in these figures and you—I won't say "error," but if these figures do not represent the amount of oil per ton of material in the apparatus are they under or over the amount per ton?

The Court: Is that the old oil, circulating oil?

Mr. Garrison: May we have the question read?

(Question read.)

2623 Mr. Garrison: That last question, is that an inquiry as to the new oil or old oil in the circulating feed?

Mr. Scott: The question refers to oil generally, one of these figures are under statement or under or over the entire amount of oil including everything.

The Court: These figures, the figures of the new oil?

Mr. Scott: Yes.

Mr. Garrison: I respectfully submit there cannot be an answer to the question, the witness having testified that they accurately represent the amount of new oil. How can they be under or over something else?

Mr. Scott: Certainly.

Mr. Garrison: I cannot see.

The Court: One may be certain of his figures, yet he may be able to say if he is wrong he has under-estimated instead of over estimated.

Mr. Garrison: I did not understand it was an estimate. I understood he said it was the exact amount.

The Court: I understood it so, yet it is an estimate for the whole day as the testimony all seems to show. He may answer.

A. These figures are obtained in this way. We weigh every bit of oil, new oil, that goes into our oil feeder, by actual weight, and a record is kept of that. And then we take tonnage samples to determine the tonnage of ore treated in the plant. The total oil

by weight put into the plant per day is divided by the total
2624 tons of new ore treated, which will give the pounds of oil per ton; and these figures are absolutely accurate as far as I know. I have not checked them but they should be absolutely accurate.

R. Q. 411. Now, in this computation here did you allow twenty pounds of oil per ton in the middling before crediting any of the middling oil to the new oil?

A. Not in that experiment.

R. Q. 412. Not in that experiment?

A. No, sir.

R. Q. 413. In these experiments here you could not allow the oil in the middlings without making allowance for oil that belonged to the solids?

A. It is counted as new oil when you include with the initial feed your circulating feed.

R. Q. 414. How are the figures obtained in the column under "pounds new oil added" and the sub-head "per ton total feed"?

A. The total weight of oil per day is divided by the tonnage of circulating feed plus the tonnage of initial feed or new feed.

R. Q. 415. "Circulating oil" subhead "total pounds," how is that obtained, the first number being 953?

A. Our analysis showed that we circulated 23 tons of feed that day, and that is multiplied by the analysis which gives the amount of oil per ton in the circulating feed.

R. Q. 416. Was it your intention in performing this experiment #1 to show the effect of 1.6 pounds of oil per ton or the effect of 6.87 pounds per ton?

2625 A. I was trying to get down to as small a quantity as I probably could and I did not know how much it would be.

R. Q. 417. What does it show in fact, the effect of how much oil per ton?

A. Well, it shows that we couldn't get good metallurgical results.

R. Q. 418. I know, but the result you got is the effect of how much?

A. Oil per ton of solids, 6.87.

R. Q. 419. Is there anything upon this tabulation to indicate that it is intended to show the effect of 1.6 pounds of oil per ton of ore?

A. No, sir.

R. Q. 420. As I understand your explanation these middlings are constantly coursing through the apparatus?

A. Yes, sir.

R. Q. 421. And the tonnage that you get, for instance, that 23 tons, in connection with your experiment No. 1, exhibit 31, indicates that during that period of time, whatever it was, eight hours, 23 tons of these middlings circulated through the apparatus?

A. Yes, sir.

R. Q. 422. And that each ton of the middlings so circulating carried the amount of ore stated in the table?

A. Yes, sir.

R. Q. 423. Or, isn't that stated?

A. It isn't stated in the table.

2626 The Court: How much is it?

A. I don't know.

The Court: You said you had 23 tons of middlings, and 1,195 pounds of old—1,195 pounds ore or oil, is that right or did I misunderstand you?

A. That is the total, not the circulation, 1,195; there is 953.

The Court: You are right.

The Witness: Did I answer your question?

The Court: Yes, I made a mistake in the heading there.

Mr. Scott:

R. Q. 424. You gave the figures for the amount of oil on concentrates and tailings, I think, and what it was in your answer to a question?

A. I did.

R. Q. 425. Was that upon the treatment of slimes by flotation or the low grade concentrate?

A. That was the low grade concentrate.

R. Q. 426. Have you corresponding figures for the slime treatments?

A. I don't think that I have them here.

R. Q. 427. You did not make these oil assays yourself, did you?

A. No, I did not.

R. Q. 428. You are not a chemist by profession, are you?

A No, sir.

R. Q. 429. In connection with the experiments recorded in exhibit 32, serially, the result obtained from commercial experiments in slime feed you were asked as to the effectiveness of the part
2627 of the mixture containing paraffin base distilled and gilsonite, and you answered that you had never tried that in a mill but that you had tried it in a laboratory?

A. Yes, sir.

R. Q. 430. With what results?

A. With a recovery of about 54 per cent when I used 20 pounds per ton.

R. Q. 431. 54 per cent recovery?

A. Yes. It was approximately 54 per cent, if I remember correctly.

Recross-examination.

By Mr. Garrison:

R. X Q. 432. Now, Mr. Janney, do I understand you from this table and the first experiment that 23 tons of circulating feed carried 953 pounds of oil?

A. Yes, sir.

R. X Q. 433. A half ton of oil to 23 tons of metal; is that correct; pretty nearly half a ton?

A. That is what the figures indicate.

R. X Q. 434. Well, do these figures correctly indicate the fact?

A. Yes, sir.

R. X Q. 435. Now, your experiment of the second was on the 29th of March, was it not; was it a twenty-four hour run?

A. Second experiment was on the 29th of March.

R. X Q. 436. And it was a 24-hour run?

2628 A. Yes, sir.

R. X Q. 437. And the third experiment was the 28th of March?

A. Yes, sir.

R. X Q. 438. And it was a 24-hour run?

A. Yes, sir.

R. X Q. 439. And the fourth experiment was the 27th of March with a 24-hour run?

A. Yes, sir.

R. X Q. 440. And the fifth was the 26th of March, with a 24-hour run?

A. Yes, sir.

R. X Q. 441. And the 6th was the 25th of March with a 24-hour run. Is that right?

A. Yes, sir.

R. X Q. 442. Now, I understood you that with respect to each of these consecutive dates that I have given you, when you ran for twenty-four hours, the amount of material that was in your machine—what is the name of that machine?

A. Dorr thickener.

R. X Q. 443. The Dorr thickener was not known to you when you began the next twenty-four hour run?

A. I did not know the exact amount. I knew it contained some oil.

R. X Q. 444. I am not talking about oil at all. I am talking about the pulp?

A. Yes.

R. X Q. 445. You did not know how much pulp it contained nor how much oil it contained? You do not know how much pulp was there?

A. No, sir.

2629 R. X Q. 446. And of course you did not know how much oil that pulp contained if you did not know how much pulp there was?

A. No, sir.

Witness excused.

RALPH AUGUSTUS CONRADS, called as a witness in behalf of the defendant, being first duly sworn, testified as follows:

Direct examination.

By Mr. Scott:

Q. 1. Please state your full name?

A. Ralph Augustus Conrads.

Q. 2. And where are you at present employed? In what capacity?

A. I am employed as metallurgist, metallurgical engineer at the Magna plant of the Utah Copper Company, Garfield.

Q. 3. What experience have you had in the line of your present employment?

A. Do you wish my general experience? Is that what you refer to?

Q. 4. And education?

A. Throughout the general industry?

Q. 5. Yes.

A. I graduated from the Missouri School of Mines in mining engineering in 1904 and from the fall of 1904, to the fall of
2630 1905, I was employed in the concentrator at Coppertown, Utah, of the Utah Copper Company. From the fall of 1905 until the fall of 1906, about one year, I was with the Balaklala Consolidated Copper Company on general engineering work and mine work in Shasta County, California. Following that I was for about six months with the Annie Laurie Mining Company in mine work and cyaniding. In 1907, from May until October, I was in coal mining work, in the engineering department in Mexico. From there I went to the Esperanza Mining Company in El Oro, Mexico, as mining engineer. About June, 1908, I was made assistant manager of the company, and remained in that position until February, 1911. After that I was in the same capacity—that is, assistant manager of the Dos Estrellas Mining Company at El Oro, Mexico. Following that I was director, or manager of a property in the state of Mexico, the Santa Ana Esperanza. I returned to this country in 1914, and in May, 1915, I went to work for the Utah Copper Company and have been in their employ ever since that time to the present date.

Q. 6. Is the flotation section in the Magna mill under your direction and charge?

A. It is, yes, sir.

Q. 7. What kind of material is treated by flotation there?

A. We are treating a part of the low grade concentrates.

Q. 8. Anything else?

A. No.

2631 Q. 9. Just the low grade concentrates?

A. Yes.

Q. 10. Is this sample similar to that at the Arthur by screen analysis?

A. It is a similar product, quite similar. The screen analysis of our flotation heading—I have here the screen analysis of February, 1917, which shows—do you want the complete screen?

Q. 11. Just approximately; I don't care about all the intermediate grades; how much goes through 150 screen, for instance?

A. There is 61.04% that will pass a 200 mesh screen. The corresponding sample for the month of January showed 62.13% passing a 200 mesh. That would be about representative, I think.

Q. 12. Have you made any investigation of flotation in the laboratory as distinguished from the actual work in the mill?

A. Well, yes, but the laboratory work at the Magna plant—we are not equipped there for extensive laboratory work, and our experiments really, while we have tried out certain things in the laboratory

on a small scale—our experiments have generally been made on a large scale. When we are satisfied that a thing is worth trying out, we have tried it out on a large scale ordinarily.

Q. 13. Which is the most reliable test, or which test is the most favorable, the laboratory test or the mill test?

2632 A. Why, the mill test, naturally; it gives you operating conditions and tonnage, etc., which are more indicative.

Q. 14. If a thing will not work in the laboratory does it necessarily follow that it will not work in the mill?

A. Not necessarily, it has been my experience; that is, not entirely so.

Q. 15. You have a record, I believe, of the flotation operations at the Magna plant, covering the periods from September 1st, 1914, to December 24th, 1916?

A. Yes.

Q. 16. Was this record prepared either by you or under your direction?

A. It was prepared under my direction.

Q. 17. And were the operations that are recorded there, carried out under your direction?

A. I was not at the plant during the entire time covered by this report.

Q. 18. Will you please state just the time when your connection with the plant began?

A. My connection with the Magna plant began in August, 1915.

Q. 19. And who had charge of them before that, if you know?

A. I should say—I think Mr. Tom Janney—at least I know that he had charge part of the time.

Q. 20. Mr. Janney who just testified before you?

A. Yes, sir. And I believe that probably Mr. Wiser—I am not sure that he had charge of the flotation department, but he was at the plant. Mr. Tom Janney had it part of the time.

2633 Q. 21. Now, referring to the part of this report subsequent to August, 1915, you may state whether it is an accurate record of what took place?

A. It is an accurate record, accurately kept, and to the best of my knowledge and belief, it is accurate in every detail.

Q. 22. Now, have you a similar record of the operations subsequent to December 24th, 1916, kept by the months?

A. I have a summary similar to that which has been kept, beginning December 25th, 1916, up to and including April 7th, 1917.

Q. 23. And were the operations for this period under your direction?

A. They were, yes.

Q. 24. During the entire period?

A. Of course I have been absent from the plant for very short periods, but they were under my direction completely.

Q. 25. Does this document headed, "Composite Flotation Retreatment Plant Results from December 25th, 1916, to April 7th, 1917, Inclusive," correctly represent the operations of the plant during that period?

A. Yes, sir.

Q. 26. Now, why were the operations up to December 24th calculated in one statement, and the latter operations in another statement?

A. Because prior to December 24th, 1916, we operated with the use of less than one per cent. of oil, and on that date or from that time forward we have operated with the use of a greater amount of oil.

2634 Q. 27. How did the results compare during the two periods?

Mr. Garrison: Now, if your honor please, I want to make the same objection that I made to the testimony of the other witnesses, that there is no connection between this and the prior art, and they have no right to introduce it at this stage of the proceedings.

Mr. Williams: I suppose it is only necessary to suggest that we would like to have these tables to refer to while counsel is examining about them.

Mr. Scott: Well, I did not think I would get into the middle of them, it is so near adjournment time.

The Court: Were you just trying to use up the time?

Mr. Scott: No, sir, I was going on asking the questions, but I did not want to hunt up the duplicates now.

The Court: The objection will be overruled. If it appears later that it has not been connected up with the condition of the prior art, the objection may be renewed, but otherwise it will be in the record if some other court has to pass upon it.

Mr. Garrison: What about this objection based upon the fact that the tables have not been submitted to us?

The Court: Well, Mr. Scott will submit them. He says that he was—I think you call it stalling, don't you? (Laughter.)

Whereupon further hearing was adjourned until Friday, April 20th, at 10 a. m.

2635 Friday, April 20th, 1917, 10:00 a. m.

Trial resumed pursuant to adjournment, all parties present; whereupon the following proceedings were had:

Mr. Scott: I now offer in evidence the two tabulations which Mr. Conrads identified and verified yesterday, but before doing so I will ask a question.

Q. 28. I would like to ask how far back in point of time you are able to testify as to the accuracy of this tabulation, covering the period from September 1st, 1914, to December 24th, 1916. You testified to the date yesterday, but I don't remember whether I asked you if your knowledge covered the whole period?

A. From August, 1915, to the last date.

Q. 29. December 24th, 1916, is the last date?

A. To the end of it.

Q. 30. Have you any knowledge as to who was in charge in the

period prior to August,. 1915, extending back to the beginning of the report?

A. As I said yesterday, Mr. Tom Janney had charge during a part of the time prior to that, though just exactly how much of the time I could not say.

Mr. Scott: Subject to the introduction of further proof prior to August, 1915, I offer in evidence the report entitled "Utah Copper Company, Magna plant, flotation retreatment plant results treating mineral classifier overflow and fourth and fifth spigots, September 1st, 1914, to December 24th, 1916, inclusive." I will supply the court a copy immediately.

Q. 31. As to this other report which we discussed yester-
2636 day, I believe you stated that you were in charge during that entire period?

A. That is the one subsequent to the first?

Q. 32. Subsequent to December 24th, 1916?

A. Yes, sir.

Mr. Scott: I offer in evidence the report entitled "Utah Copper Company, Magna plant, metallurgical department, composite flotation retreatment plant results for period December 25th, 1916, to April 7th, 1917, inclusive."

Papers admitted in evidence and marked Defendant's Exhibits 35 and 36.

Mr. Garrison: I desire to cross-examine before this paper is admitted.

By Mr. Garrison:

Q. 33. Mr. Conrads, I hand you the paper marked Defendant's Exhibit 35 and ask you what your relation was to the work that is represented on that sheet?

A. I was in charge.

Q. 34. Oh, yes, I know as to the date.

A. My relation?

Q. 35. Yes.

A. I was in charge of the entire direction of the work, the results of which are represented on this sheet.

Q. 36. You were the man who had practical charge of the work?

A. I had charge of the entire department.

Q. 37. You were the man who had practical charge of the work, by somebody else bringing you reports—not theoretical charge, but actual charge of what was done, and what was done was done by your orders?

2637 A. With this exception. I have the direction of the plant, but the operators naturally are under the mill foreman, but I direct the work. I would order any changes that were made and I watched the result.

Q. 38. You were the metallurgical engineer?

A. Yes, sir.

Q. 39. You are not the man who has charge of the plant practically, practical charge of the work?

A. I am in charge of the plant. The men, the operators themselves, are under the immediate direction and responsible to the mill foreman, but so far as the dictation of what they shall do in the plant and the operation of the plant, I dictate that.

Q. 40. In other words you lay down a policy and they carry it out?

A. The general mill foreman is directly over them, but the plant is run at my direction.

Q. 41. In other words you lay down a policy and they carry it out?

A. Yes.

Q. 42. What you know with respect to what they do is contained in reports that are furnished to you by or through the mill foreman, is not that correct?

A. I have a personal knowledge, because I spend a great deal of time right in the plant.

Q. 43. Do you go from point to point every day and put down notations yourself about what is being done?

A. I make the rounds regularly, or at various times, noting the conditions and everything pertaining to the plant in its operation.

2638 Q. 44. Is this sheet made up from your own original notations?

A. That sheet is made up from results which we systematically get.

Q. 45. (Question read: Is this sheet made up from your own original notations?) Answer yes or no?

A. It is not.

Q. 46. Then this sheet is made up of something written down on paper by somebody else and furnished to you? Isn't that correct?

A. This sheet is made up of tonnage measurements which are regularly and systematically taken, of the percentage of solids in the feed and the various items contained in that report are done in a regular and systematic way and under my direction.

Mr. Garrison: Read the witness the question. He has not answered it.

(Question read as follows: "Q. 47. Then this sheet is made up of something written down on paper by somebody else and furnished to you? Isn't that correct?)

Mr. Garrison: Yes, or no?

A. It is compiled from regular and systematic reports which I received.

Mr. Garrison: Read the witness the question; he has not answered it.

(Question read as follows: "Q. 48. Then this sheet is made up of something written down on paper by somebody else and furnished to you? Isn't that correct?")

2639 Mr. Garrison: Yes, or no?

A. I think I answered that question.

The Court: He has asked you if you received written statements and reports from others and you say you received reports, but you do not say whether they were written or not. You may answer it yes or no, and then qualify it.

A. Yes, I received written or typewritten statements of regular operations.

Mr. Garrison:

Q. 49. And this is what this sheet is made up from?

Mr. Kremer: You have a perfect right to explain it as the court told you.

The Court: Read the witness the answer.

(Answer read as follows: "Yes, I received written or typewritten statements of regular operations.")

Mr. Garrison: Do you want to add anything to that?

The Witness (continuing):—which cover the operations of the department in detail as represented on this sheet and which are regularly and systematically taken and reported to me.

Q. 50. Then this sheet is compiled from reports of this character that are furnished to you; isn't that correct?

A. Yes, sir.

Q. 51. Do you yourself make any of the calculations which appear upon this exhibit, for instance "percentage of solids," do you make up the calculations which result in the figures which appear in the column headed "Percentage of Solids"?

2640 A. I personally do not make up the figures. I do, however, endeavor to check them sufficiently to satisfy myself as to their accuracy.

Q. 52. Is that true with respect to all of the other headings and the figures underneath?

A. Yes, sir.

Q. 53. They are furnished originally by someone else, but you endeavor to check them sufficiently to be assured of their accuracy? Is that correct?

A. Yes, sir; to the extent that I reasonably can, considering the amount of work embraced in the department.

Mr. Garrison: I have no objection to the competency of this subject to our usual objection as to its relevancy.

Q. 54. Now, with respect to the paper marked defendant's exhibit 36, what you have said with respect to the source of information, and the compilation under your own personal supervision as to exhibit 35 is also true with respect to 36?

A. With this exception: that on the former exhibit referred to I can only personally testify as to results of a part of that.

Q. 55. You mean as to the date?

A. As to the date. But in other respects this is exactly similar.

I can testify in the same way to that.

Q. 56. And it was made up in the same way?

A. Yes, sir.

Q. 57. From the same sources, and your personal perception is the same?

2641 A. Yes, sir.

Mr. Garrison: I have no objection to the competency of this. I object to its relevancy. I think it is plainly irrelevant.

The Court: You have the general objection, I suppose.

Mr. Garrison: Yes, sir.

The Court: Estoppel, and all?

Mr. Garrison: Yes, sir. What I would say, I think this paper is competent if the evidence is relevant. He has competently proven the paper but I do not think it is relevant.

The Court: The objection as to estoppel, you must remember you have claims 9, 10 and 11 which certainly there would be no estoppel on by virtue of the judgment in the other suit at least, but the same ruling will be made, and of course will be all finally determined at the end of the suit, and an exception allowed.

Mr. Garrison: Yes, sir.

Whereupon the sheets were admitted in evidence and marked defendant's exhibits 35 and 36.

Direct examination (continued).

By Mr. Scott:

Q. 58. Mr. Conrads, this first report from September 1, 1914, to December, 1916, has been designated exhibit 35, and I will use that for brevity, and the next one has been received in evidence as exhibit 36.

2642 A. Exhibit 35 covers the period from September 1st, 1914?

Q. 59. That is it; that is 35. The other one is exhibit 36.

Mr. Garrison: Have you any copies of that?

Mr. Scott: No, I have not. This is the only copy.

Mr. Williams: I give you notice that for the purpose of cross-examination I must have an extra copy of these exhibits to hand to my experts.

Mr. Scott: The court has an extra copy and you can use the original.

The Court: Be careful that no other markings are made.

Mr. Scott: Mr. Conrads, will you just tell us briefly how these figures are ascertained in the first column, in exhibit 35, "Tonnage." I mean the physical method of finding out what that tonnage is.

A. At the head of the flotation plant or flotation machines, there is a sludge tank into which the feed which is prepared for treatment is laundered, and that figure of tonnage is arrived at by weighing the entire flow for a brief space of time, getting its weight, for instance, for a period of 15 or 20 seconds, and at the same time taking

a sample to determine the percentage of solids contained in the flow. By that means we are able to determine the percentage of solid matrial entering the machine for a definite space of time; and as that is repeated during the day at regular intervals, the tonnage for the day is compiled from that.

2643 Q. 60. On this table, exhibit 35, that part of it to which your knowledge extends, is any account taken of the circulating oil?

A. No.

Q. 61. Before we proceed any further, Mr. Conrads, will you make just an outline sketch that you can draw in three or four minutes, probably, of the position of these different flotation cells, with arrows, and so forth, to designate the course of the pulp and the return of the middlings, if there are any, and the position of the cleaner, if there is one, so that your testimony will be clear—nothing elaborate, but just a rough outline.

A. Just a rough sketch of the original flow, the disposition of products and the circulating feed?

Q. 62. And the cleaner, if any.

A. (Witness drawing.) I think that about represents it. The original feed which is prepared for flotation, flows into the sludge tank, which is marked here "sludge tank." The sludge tank receives in addition to this original or new feed the circulating load from the lower end of the machine; that is, the cells which are not making a finished high grade concentrate. Those overflow directly —that overflowing froth is run into the launder which I have marked circulating feed launder——

Q. 63. Tell the court what each of these circles and things represents; I don't know that he understands.

A. Oh, yes. I was getting a little ahead of my story. What I have endeavored to represent here is the general plan of one

2644 full section of the flotation department, which consists of a sludge tank, a mixing box, where the oils and reagents are introduced——

Q. 64. The oil is added in the mixing box and whatever reagents you use—they are added as it comes from the sludge tank?

A. The feed from the sludge tank is drawn through a molasses gate or plug into the mixing box, where it is mixed with the new oil and in our case an alkaline reagent. From there it flows to the first emulsifying cell.

Q. 65. What is that emulsifying cell?

A. It has been described before in connection with the Janney machine. It is simply a cell which is equipped with a vertical motor, driving impellers, which run at the rate of 570 revolutions a minute under full load.

Q. 66. What effect does that have upon the pulp?

A. That is the agitating or emulsifying operation, the preparation of the feed.

Q. 67. Does it mix the oils and the reagent up with the pulp?

A. Yes. Now I have indicated here the three emulsifiers, which are in series. The feed goes into the first, and leaving that it goes

into the second and the third. From the third it goes into the first treatment cell, of which there are 16 in the section. I don't know just how many I have represented, but that is immaterial I guess.

Q. 68. You have represented about 12?

2645 A. Well, I have marked "and so forth."

Q. 69. Well, I see you have eleven, so the and so forth means five?

A. All right. Well, to go ahead with the flow, after passing the emulsifiers the feed flows into the first cell from which it overflows into spitzkastens on the side, these being double spitzkasten there is a spitzkasten on either side.

Q. 70. What is a spitzkasten? And what is its purpose?

A. The spitzkasten is a pointed box.

Q. 71. Pointed at the bottom?

A. A "V" shaped box into which the pulp from the cell proper, where it is agitated, overflows. There the froth flows off of the top and falls into a launder.

Q. 72. What is the purpose of flowing the pulp into the spitzkasten, to gather the froth?

A. It is a quiescent state.

Q. 73. The pulp is quiet here and that permits the froth to rise?

A. Yes. Here it is subjected to a very violent agitation, and overflowing from that cell it goes out into the spitzkasten, where it is relatively quiet.

Q. 74. Under flowing from one to the other?

A. Well, it overflows in this case. The pulp from the cell into the spitzkasten is introduced under a baffle, which submerges it about two and a half inches under the level of the pulp, and the spitzkasten—now, I have indicated here three cells as going to high grade, which is a variable quantity. In the case of extreme

2646 heavy mineral load it is more, and in the case of a lighter load it is less. In other words, we simply cut in more cells to high grade and less to low grade as the conditions warrant.

Q. 75. You mean that the product from these three or four cells is taken off separately from that of the latter cells?

A. Yes; these first cells make a finished concentrate which is high grade and ready for shipment when settled, without any further concentration.

Q. 76. How about the lower cells?

A. The lower cells are not; they are lower grade; containing more silica and having a lower grade concentrate which is not sufficiently concentrated or clean enough to be considered finished or ready for shipment.

Q. 77. What is done with the concentrate from these lower cells?

A. From these lower cells that concentrate is returned to the sludge tank and reintroduced, along with a regular feed.

Q. 78. That is your circulating load?

A. That is our circulating load? I have indicated on this sketch only three cells going to high grade, and the balance being returned to circulating load; however, that is a variable condition, we can cut in four or five or six or all, if necesary.

Q. 79. Just make a note there that there are 16 cells there; three emulsifiers and sixteen cells?

A. Yes, I will make that.

Q. 80. Is there any thickening in this sludge tank, or is it simply a receiving tank?

2647 A. That is a receiving tank.

Q. 81. No Dorr thickener makes a part of this plan?

A. No. We have a Dorr thickener, but it is ahead of this. The sludge tank receives the thickened pulp. I have only represented this from the point after the thickened feed goes into the plant.

Q. 82. After the thickened material goes into the sludge tank it never goes to the Dorr thickener again?

A. No, sir, not after it comes in here.

Q. 83. This is the final tailings, which comes out at the end of those 16 cells.

A. The final tailing from here is the final tailing of the mill.

Q. 84. These cells are in series; what leaves one goes into the next and so on.

A. A straight series from start to finish. Every bit of feed that enters this first emulsifier, or every bit of feed into the section enters the first emulsifier and flows in series to the second emulsifier and to the third emulsifier, and in series right through the machines.

Q. 85. Part of the froth being taken off as it goes on through?

A. Yes, exactly, either to high grade or to circulating load.

Mr. Scott: I offer the illustrated sketch made by the witness in evidence.

Sketch admitted in evidence without objection and marked Defendant's Exhibit No. 37.

The Witness: I did not indicate on there anything about the tailing or the waste product, I have only indicated the concentrates.

2648 Q. 86. Well, you can put an arrow showing where the tailing goes; that will be sufficient, I guess.

A. All right, I will do that. (Witness drawing.)

Q. 87. In this table, exhibit 35, in evidence, is any record made or account taken of the circulating load or the oil in the circulating load?

A. In exhibit 35?

Q. 88. In exhibit 35.

A. There is not.

Q. 89. Does this sketch, which you have just made, exhibit 37, represent one of the several sets of apparatus?

A. One of two at the Magna plant.

Q. 90. And that comprises the Magna plant, those two sets of apparatus similar to what is shown on exhibit 37?

A. Yes, sir.

Q. 91. Just state the extreme limits, the range of the amount of oil shown on exhibit 35.

A. The extreme range as indicated there——

Q. 92. (Interrupting). Per ton, I mean.

A. Yes. The lowest amount of oil used in that period was an average for the month of March, 1915, which was 1.23 pounds of oil per ton.

Q. 93. And the highest was?

A. The highest was 5.37, which was the month of April, 1916.

Q. 94. Does the record in evidence as exhibit 36, take into account the circulating load, both of solids and oil?

2649 A. Yes.

Q. 95. About the center of the sheet there is a column entitled "Pounds, New Oil Added." Now just tell us what the figures in that column represent.

A. The figures in that column headed, "Pounds of New Oil Added" is the actual weight in pounds of new oil, that is not considering oil from circulation.

Q. 96. That is the oil consumption rather?

A. Yes, that indicates or represents the new oil consumed.

Q. 97. Now, referring to the column entitled "Pounds of Oil in Circulation," please state what the figures in that column represent and how they are determined.

A. Pounds of Oil in Circulation?

Q. 98. Yes.

A. That represents the total amount of oil in that circulating load.

Q. 99. The figures being for the month—this being monthly statement?

A. Yes, that is for the month.

Q. 100. Now, will you tell me how these figures are determined? I don't want the assay method, but I want the way of getting the samples, etc.

A. The return feed or circulating load is regularly sampled as it enters the sludge tank and the amount of oil is determined in that feed, from samples, in pounds per ton of wet feed in the way that we originally determined it.

Q. 101. Pounds per ton of wet feed?

2650 A. Of wet circulating load. At the same time we get another sample which is dried in order to determine the per cent of solids in the feed or in that circulating load. From these we can calculate the various things that we want for this sheet.

Q. 102. The next column is entitled, "Excess pounds of Circulating Oil." Now I wish you would explain the meaning of that heading and what the figures represent.

A. The excess pounds of circulating oil is the amount of oil left after satisfying the dry tonnage in the circulating load with 20 pounds of oil per ton.

Q. 103. You name 20 pounds because you were aiming to supply——

A. (Interrupting.) We were aiming at 20. I was going to modify that in this way: There have been times that I ran some tests which will probably be referred to, in which we used varying amounts, and at that time, that dry tonnage in the circulating load

was satisfied with its amount, that is, the amount that we were aiming at during that test.

Q. 104. So the word "excess" means excess over and above the amount of oil per ton of solids you are attempting to supply to the machine?

A. Exactly.

Q. 105. And if that amount you are trying to get is 20 pounds, why, the excess is the excess over and above 20 pounds?

A. Yes. We calculate the total amount of oil in that circulating load. We calculate the total dry tonnage in the circulating
2651 load. Then we deduct from that total amount of oil sufficient oil to satisfy that dry tonnage which is entering the head of the machine in the circulating load and credit the excess oil as a balance.

Q. 106. What is the object of determining that oil in the circulating load, in determining its excess over the predetermined amount you are attempting to supply.

A. In order to ascertain the total amount of oil entering the machine.

Q. 107. And what relation does it have to the amount of new oil you have?

A. Well it simply augments.

Q. 108. Simply what?

A. It just augments the amount. If we have, for instance, 15 pounds of new oil per ton going into the machine, and we have 10 pounds, for example, of excess oil from circulation, it shows a rate of 25 pounds of oil entering the head of the machine per ton of dry feed entering it. Does that answer the question?

Q. 109. I think so. The column entitled "Pounds of Oil in Circulation" contains figures which are obtained how?

A. "Pounds of Oil in Circulation"?

Q. 110. Yes. That is the one we just had.

A. That is the one we explained.

Q. 111. Yes, I made a mistake. The column I meant was, "Total Pounds of Oil, New, Plus Excess."

A. "Total Pounds of Oil, New, Plus Excess" is the figure
2652 I referred to just a minute ago. That is, the pounds of new oil per ton of original feed plus the pounds of circulating—excess circulating oil per ton of original feed.

Q. 112. Take the second entry there for the month of January, that is obtained simply by adding 528,760 in the "Pounds of New Oil" column and the 103,358 in the "Excess Pounds" column, gives us 632,118 pounds?

A. Correct.

Q. 113. Now the pounds of new oil per ton is simply a matter of calculation from the preceding column?

A. The pounds of new oil per ton?

Q. 114. Yes, that column is simply——

A. (Interrupting.) That is simply the total amount of oil divided by the total tonnage of new feed.

Q. 115. The column "Pounds of Circulating Oil Per Ton" of new

feed is figured on the entire tonnage, including new feed and the circulating load?

A. The pounds of circulating oil per ton—yes, that is the total circulating oil divided by the tonnage.

Q. 116. Now, taking this column "Total Pounds of Oil Per Ton, New, Plus Excess," the figures in which two columns are added to obtain the figures in that column?

A. The figures in the column "Total Pounds Oil Per Ton, New, Plus Excess"?

Q. 117. Yes.

A. That is the sum of the "Pounds of New Oil Per Ton" and the "Pounds of Excess Circulating Oil Per Ton."

2653 Q. 118. In the case of the month of January the sum of 18.41 and 3.60?

A. Right.

Q. 119. Now, I notice that in the month of January, which is the second entry, you take credit for 3.6 pounds per ton of excess circulating oil?

A. Yes, sir.

Q. 120. Have you any explanation as to how that amount of circulating oil builds up in the apparatus?

A. How the circulating load or the amount of oil in circulation builds up?

Q. 121. Yes, how it builds up to that extent.

A. Well, that is a condition which arises in various places, in metallurgical plants. Now, for instance, we introduce a certain amount of oil, a new oil, into the head of the machine. There is a part of that oil which is discharged with the concentrate and is lost to circulation. Now, coming down to the return cells, the froth from these return cells which go to make up the circulating load contains a certain amount of oil, the froth and pulp generally. Now, that is returned to the sludge tank and that load carries with it a certain amount of oil. There it meets the new oil, or as it goes into the head of the machine, it meets the new oil, and that process is repeated, some of the oil being lost in the concentrate. That is lost from the machine, and as you go down, the machine, the return cells continually throw over oil which is returned into circulation.

Q. 122. Referring to these lower cells of the series from which the froth is returned as a middling to the sludge tank, does that froth carry with it more or less water when it goes back?

2654 A. Yes, sir.

Q. 123. And what is its condition as to its capability of flowing in a launder?

A. Well, it is sufficiently thin to flow.

Q. 124. Thin enough to flow?

A. Thin enough to flow, yes.

Q. 125. And the oil that is carried back with these middlings, where is it; in the water or in the concentrate or both or what?

A. Well, that—to say exactly where that is, I can not tell you just in what proportions that would be represented in the water or in the mineral, or exactly what the various proportions of that oil is,

but it is certainly safe to say that a great deal of it is carried right in the water, in the general water.

Q. 126. Your determination simply is a determination of the total amount of oil regardless of whether it is sticking to the solids that are in the water, or whether it is emulsified in the water; is that the idea?

A. Our determination is simply the amount of oil in that feed, regardless of what it is or what condition it is in.

Q. 127. Now, during these months from December to April, recorded on exhibit 36, I note you have used quantities of oil for January, February and March in excess of 20 pounds; I would like you to compare the metallurgical results obtained during these months with the metallurgical results shown on exhibit 35 covering the period when smaller amounts of oil were used.

A. Well, one of the most noticeable things, or first to be
2655 noted is the comparison in the per cent of copper in the tailing. Now, in exhibit 35 we have an average of .290 as a per cent. of copper in the tailing. That is, that represents a loss. Now, on exhibit No. 36 we have in the corresponding figure, .157.

Q. 128. Well, I am talking now, the average for the five months.

A. Yes.

Q. 129. Now, will you make the same comparison individually with January, February and March, during which months the amount of oil was above twenty pounds?

A. Well, we have in January—we used an average of 22.01 pounds of oil per ton, and our average tailing for the month was .106 per cent. copper. For February we used an average of 23.21 pounds of oil per ton and made a tailing containing .121 per cent. of copper. For March we used 20.62 pounds of oil per ton and made a tailing of—that figure is blurred a little bit; it looks like .161.

Q. 130. It is .181 here?

A. .181 that figure is. It is a little blurred on this copy. Now for the month of April, which will naturally attract anyone's attention, the tailing there is .402.

Q. 131. Isn't it .401?

A. .401, yes. But that is due to another cause.

Q. 132. What was the cause?

A. Well, during that time I made some tests or rather, complete day runs in a reduced amount of oil. You will see that the average for those first seven days was 16.08.

2656 Q. 133. This table does not show anything about the seven days. You know that cannot cover the whole month?

A. No.

Q. 134. How many days does it cover in April?

A. The days on which we used the low amounts?

Q. 135. Yes.

A. The first and second.

Q. 136. Well, this average result for April, which part of April do they cover?

A. From the first to the seventh inclusive.

Q. 137. Now, will you make the same comparison as to the indi-

cated extraction under the conditions represented upon exhibits 35 and 36?

A. Referring to exhibit 35 the percentages of indicated extraction—the average for the entire period was 97.461 per cent., and for the subsequent period covered by exhibit No. 36 the indicated extraction for the entire period was 98.161.

Q. 138. How about the individual months during that period represented by exhibit 36?

A. Well, the individual months, with the exception of the seven days in April and for which I suggested an explanation as to the cause of that low extraction—with that exception the indicated extraction is above 98 per cent., in fact very close to 99 per cent. in two cases.

Q. 139. How about the month of March?

2657 A. That is, above 98 in three cases, and in the month of March 97.887, which is practically 98 per cent.

Q. 140. How does the grade of the concentrate compare in value during the periods represented by exhibits 35 and 36?

A. Well, for exhibit 35 the average of the concentrate produced was 30.294 per cent copper, and for the subsequent period covered by exhibit 36, the average is 28.458.

Q. 141. That is, taking into the average the April results?

A. Taking into the average the April result, yes, 24.731.

Q. 142. And while you are stating that, just state the copper contents for December, January, February and March of the concentrate?

A. The copper content of the concentrate for December was 33.218; for January 29.414; for February 29.337; for March 27.369.

Q. 143. Does any factor enter into the value of these copper concentrates other than the amount of copper, the proportion of copper?

A. Yes, the percentage of silica or insoluble is one factor.

Q. 144. State what that has to do with it, the percentage of silica.

A. The percentage of silica is a disadvantage, in that it represents so much material which carries no value—that is,

2658 metallic or mineral value. The freight transportation has to be paid on that.

Q. 145. Does it have anything to do with the smelting?

A. And also in smelting if there is an excess of silica over iron the smelting of that has to be paid for specially.

Q. 146. If the silica and iron balance each other, it leads to no additional smelting charge?

A. It leads to no additional smelting charge. There is an additional charge when the silica exceeds the iron content.

Q. 147. How do these concentrates, during the period represented by exhibit 35, compare with those for the period represented by exhibit 36 in the matter of the relation of the amount of silicia and iron?

A. For the period covered by exhibit 35 we have an average percentage of 21.013 per cent iron and 16.116 per cent insoluble. For the period represented by exhibit 36 we have 21.196 per cent iron and 17.359 per cent insoluble.

Q. 148. Do you regard the difference between these figures as substantial or not?

A. In the view of other results it is not. Now there is an excess—I haven't figured it exactly, but there is about five per cent excess of iron on exhibit 35 and in round numbers four per cent on exhibit 36; in both cases the iron exceeds the silica.

Q. 149. That is the principal thing, is it?

2659 A. That is the principal thing—that is, not the principal thing, no; in that connection it is the principal thing, but the principal thing really is the difference in the extraction, as represented by the very much lower tailing during the last four months, or since December 25th.

Q. 150. In our operations do you encounter any other instance of a circulating load, other than the circulating load we have discussed in connection with this flotation operation?

A. In general you mean?

Q. 151. Yes, in general metallurgical operations?

A. Why, yes; that matter of circulating load, we find that frequently in one connection or another. There is a very simple one, for instance, in a crushing plant. Take, for example, a plant which is, we will say, crushing a hundred tons a day, now that feed, we will say is crushed in rolls for example. After passing the rolls it is screened. The under size is passed on for further treatment, while the over size or the part that is not reduced fine enough to pass the screen, is returned to the rolls for regrinding. Now, we have that steady constant rate of 100 tons per day of new material. That circulating load, due to this returned over size, may build that load up so that you are crushing—the work that the rolls are actually doing will be four or five hundred tons, or perhaps more than that, per day. Now, I think that is comparable, in that we will say you

2660 have a hundred pounds of new oil going into your flotation machine; you have a certain amount that is lost in circulation by going out with the concentrate, we will say; that would compare to the under size from that screen, which is lost to the circulation through the rolls. Then we have the oil which is contained in the middling, or circulating load, which is returned; that would be comparable to the over size which is returned to go through the rolls again. So that at any one minute we would have much more than the indicated rate of new feed as a load for the rolls.

Q. 152. Now, referring again to exhibit 36, we have a column "pounds of new oil per ton." That includes the entire tonnage, the new feed as well as the circulating solids, does it?

A. No.

Q. 153. It does not?

A. No, it does not.

Q. 154. It is pounds of new oil per ton of new feed?

A. Yes. The dry tonnage in the circulation is taken care of by itself in our calculations. We satisfy it with its proper amount of oil before we make any credit for the excess circulation.

Q. 155. What was the material that was being treated during this time recorded in exhibit 35; it is described as being mineral, "classi-

fied overflow, and fourth and fifth spigots" in the title of the record. Can you tell us what that is?

2661 A. The material which we treat by flotation is a part of the low grade concentrate made in the mill. Now, in saying a part, I will explain that that part is gotten in this way: the entire product of the low grade concentrate is classified in the hydraulic classifiers of five compartments each. Now the coarsest material which comes down in the first spigot, along with the next coarsest in size in the second, and the succeeding in the third compartment—the products from those three spigots are treated on Wilfley tables. The product from the fourth spigot and the fifth spigot, along with the overflow from that classifier, is pumped to thickeners; we use both the cone tanks and the Dorr thickener for thickening this product. Then the under flow, or the thickened product from both the cone tanks and the Dorr tank is laundered to the flotation plant for treatment.

Q. 156. Have you any figures regarding its fineness?

A. Yes. Well, yesterday I gave the screen analysis of the flotation heading for February as 61.04 per cent passing through a 200 mesh.

Q. 157. Well, never mind; I had forgotten that you gave that.

A. It is quite a fine product.

Q. 158. Was the same material being treated during the period recorded in exhibit 36?

A. Yes.

Q. 159. Generally, was the material of the same character during the periods represented by 35 and 36?

2662 A. Yes. Now, in going over the old records, I will say that there is just a little difference, which does not amount to anything, and that is, that there was a period of experimentation, when they used some of the third spigot product, but that is only a relative matter; but the product is essentially the same product.

Q. 160. What is the most important element in the operations of your plant, if you can state it in that way, recovery or the grade of the concentrate?

A. Why, recovery is the most important.

Q. 161. Now I believe you have made some tests designed to show comparative results with different amounts of oil, have you not?

A. Yes.

Q. 162. Have you a record of those tests?

A. I have, yes. You refer to the statement marked "statement showing loss in pounds of copper and consequently monetary losses due to abnormal tailing caused by variation in the amount of oil——"

Q. 163. Yes, I believe that is it. The title is "Utah Copper Company, Magna plant, statement showing loss in pounds of copper and consequent monetary loss due to abnormal tailing caused by variation in amounts of oil used per ton of ore treated, December 25th, 1916, to March 24th, 1917, and abnormal test March 25th to April 2nd, 1917." I will ask you if these operations recorded uopn this paper were carried out by you?

2663 A. Yes, sir, under my direction.

Q. 164. And you can state that the results here recorded are correct?

A. To the best of my knowledge and belief I think they are accurate in every detail.

Mr. Scott: I offer this report in evidence.

Report marked Defendant's Exhibit 38 and admitted in evidence.

Mr. Garrison: I would like to cross examine as to this.

By Mr. Garrison:

Q. 165. These were experiments were they?

A. Well, if you want to classify them as experiments—we were trying out that condition; if that is what you mean by an experiment—but we did it on full scale operations.

Q. 166. But I mean it was not the ordinary operation in your mill; it was done for the purpose of ascertaining the effect of running your mill under certain conditions?

A. It was a variation in the amount of oil per ton of the ore treated by flotation, but applied to our regular heading and the entire amount of feed under treatment.

Q. 167. (Last question read.) You can answer that yes or no, can't you?

A. I don't believe that that can be answered directly without certain qualification.

2664 Q. 168. Why not?

A. Because we are continually varying our conditions; that is, we may be at any time varying our conditions as to the amount and kind of oils, reagents, and such variable things, and we do that in our regular operations.

Q. 169. Those were different conditions, weren't they?

A. We vary our condition from one time to another.

Q. 170. And those variations or different conditions—they were different conditions, weren't they, different one from the other?

A. Yes; we differ one from another in our regular operations—one day from another.

Q. 171. I haven't asked you that. I say when you do make these variations they are with respect to each other different conditions, aren't they?

A. They are different conditions, yes.

Q. 172. Then I will ask you whether or not these things shown on here which are different from the normal and which are designated as abnormal were done for the purpose of ascertaining the nature of the abnormal conditions which are different from the normal conditions; isn't that correct?

A. Yes, sir.

Q. 173. And they were all done by you or under your direction?

A. They were all done under my direction.

2665 Q. 174. And you are satisfied that you can testify as — the verity of the figures?

A. Positively, yes, sir.

Q. 175. And as representing truthfully the conditions that existed in the mill at the time that these figures show the record?

A. Yes, sir.

Mr. Garrison: We have no objection as to the competency.

The Court: The result of what we might call the permanent objection is permanently overruled at the present time.

The document admitted in evidence and marked Defendant's exhibit 38.

Direct examination (continued).

By Mr. Scott:

Q. 176. What was the general purpose of these operations represented by exhibit 38?

A. The general purpose of these operations was to determine and note the effect produced by the reduction in the amount of oil per ton of ore treated without any variation in the oil combination itself, in its proportion; simply in the amount of that combination being used per ton of feed.

Q. 177. In reducing the amount progressively, as I have—as I see you have done, did you adhere rigidly to the conditions pre-
2666 vailing when you used the maximum, 22.18 pounds; or did you adapt, as best you could, the conditions to the varying and smaller amounts?

A. Well the conditions—We ran that under two general conditions. We would run, for instance, on the 25th and 26th of March, we ran on those two days under the normal conditions of carrying the circulating load and we included, or include the amount of oil in excess of 15 pounds per ton of pulp in the circulating load.

Q. 178. You did that because it was your effort to arrive, as nearly as possible, at 15 pounds per ton?

A. 15 pounds is the amount that we endeavored to maintain, 15 pounds per ton of feed during those two days.

Q. 179. And on March 25th and 26th, the amounts, I note, taking into account credit for the circulating oil were, 16.17 and 15.84. That is correct, is it not?

A. Yes. Now, for March 27th and 28th we eliminated the circulating load.

Q. 180. So that 16.23 for March 27th and 16.41 for March 28th represents the amount of new oil relative to the new feed, the circulating feed being ignored entirely?

A. Yes, the new feed was the total feed on those days because there was no circulating load.

Q. 181. You cut the circulating load out?

A. Entirely, every cell.

2667 Q. 182. The pulp flowed straight through the machine from end to end without any circulating load at all?

A. Yes. What froth was discharged from each and every cell went directly to the high grade concentrate.

Q. 183. Then, as I understand your last answer, upon these days when you did not take credit for circulating oil, you didn't have any circulation; you eliminated the circulation entirely?

A. Didn't have any; there positively was no circulation at all; no circulating load.

Q. 184. It was not a question of not taking into consideration something that was present, but you simply cut the circulating load out of the system altogether?

9. We absolutely did not have a circulating load.

Q. 185. The first entry is designated "Normal" and the amount of oil is 22.18 pounds. What is the meaning of the word "normal" in that connection?

A. We assume or assumed the average condition as obtained—or average results as obtained from December 25th to March 24th inclusive as the normal condition of operation under the large amount of oil or the increased amount of oil from our prior practice.

Q. 186. Normal, as representing your present mode of operation with over one per cent of oil?

2668 A. Yes. In other words we began the use of the large amount of oil on the 25th of December, and at the time that these tests were begun, on the 25th of March, we simply took our average results for the entire period up to that time, and assumed that as the normal figure, as the basis of comparison.

Q. 187. Oh, yes. That entry "normal" you say covers the period from December 25th, as stated, 1916, to March 24, 1917?

A. That is just before these tests were begun.

Q. 188. Now, what was the result of these tests with regard to the efficiency of using less of this mixture than 22.18 pounds which you took as the normal average?

A. Well, we found we got vastly better results with the greater amount than we did with the reduced amount. Now, this statement carries that out for the purpose of comparing the difference in operation, that is, the percentage of copper in the tailings, and so the actual loss in operating under the different conditions. And then we go ahead and figure what that loss means in money at the assay of the tailing, that is, the actual amount lost on the actual tonnage of tailing which was discharged from the plant during the test; and the loss is figured at 15 and 20 and 25 and 30 cents per lb. in order to determine the monetary loss.

Q. 189. So that we are sure that we have it right, and instead of having it in this table, suppose you run right down that first 2669 column of dates, and the amount of oil and just state briefly what the amount of oil was in each of these runs and how it was computed and whether the machine was circulated—operated with circulation or not.

A. The first figure under the column "Average Pounds Oil Used per Ton of Ore Treated" is 22.18, and that represents the average pounds of oil per ton during the entire period from December 25th, 1916, to March 24, 1917, inclusive. Now, on March 25th it was endeavored to maintain an average of 15 pounds of oil per ton including the excess oil from the circulating load. On March 26th the

same condition obtained. On March 27th and 28th it was endeavored to use 15 pounds of oil per ton, that being only new oil, though. There was no oil credited from circulation and positively no circulation, as the discharge from every cell was direct into the high grade launder and nothing whatever was returned to circulation. On March 29th there were no tests made. On March 30th it was endeavored to use 10 pounds of oil per ton of feed without circulation, the same condition obtaining as did on March 27th and 28th. All froth was discharged to concentrate launder. On March 31 it was attempted to maintain the oil at 10 pounds per ton including excess oil from circulation, and the excess in this case being after the dry tonnage in circulation was satisfied, with 10 pounds of oil per ton. On April 1st it was attempted to maintain the oil at 5 pounds per ton of feed without circulation. And on April
2670 2nd it was attempted to maintain the oil at 5 pounds per ton inclusive of the circulation, inclusive of the excess oil from circulation; and in this case, excess oil is the amount of oil in excess of 5 pounds per ton of dry pulp in circulation.

Q. 190. Now, referring to the column, "Average per cent. Copper in Tailings" does there seem to be a fixed relation between the efficiency of operations when you figure the oil with and without circulation, or whether you operate with and without circulation and figure the oil accordingly?

A. Well, on March 25th the average per cent. copper in tailings was .241, and on March 26th it was .278.

Q. 191. That is, with circulation?

A. That was with circulation.

Q. 192. At 15 pounds?

A. Yes, approximately, or we endeavored to hold it at 15 pounds. Now, without circulation, on March 27 and March 28 we have .249 and .300 respectively.

Q. 193. What is the difference between these figures such as, to one of your experience would be regarded as involving a substantial difference or as being substantially identical?

A. I cannot see that there is any substantial difference, anything specially noteworthy.

Q. 194. Now, taking March 30th and 31st with the effort—when the effort was to use 10 pounds, and which shows about 10 pounds were used, how do the tailings compare with circulation and without?

2671 A. On March 30th we used 10.63 pounds of oil per ton without circulation and made a tailing of .589% copper, and on March 31 the total oil inclusive of excess oil from circulation averaged 10.33 pounds per ton in the feed and the average copper in the tailings was .486, which is a little lower than that made without circulation.

Q. 195. About one-tenth of a per cent.?

A. Yes.

Q. 196. Now, with your operation, attempting to fix the oil at 5 pounds with and without circulation, will you compare the copper in the tailings?

A. On April 1st we ran without circulation, used a total of 5.16 pounds of oil per ton of feed and made an average tailing of .560% copper; on the 2nd of April we used a total of 4.16 pounds of oil per ton treated, which figure includes excess oil from circulation after crediting the dry pulp in circulation with 5 pounds of oil per ton, and an average tailing made that day was 1.277%.

Q. 197. Do you know any facts to explain that rather high tailing with circulation at 5 pounds as compared with the lower tailing without?

A. Why, yes, there is an explanation I think, that will apply there—it certainly does apply, and that is that there was on that day not enough oil to satisfy the mineral in the pulp. There was no oil accumulated from that circulating load. There was not enough oil there to satisfy the mineral. We had a great deal of dif-
2672 ficulty that day. While we aimed at 5 pounds of oil per ton we only got to 4.16. There was simply not enough oil in the system, in the machine.

Q. 198. Now, what was the general trend of results to the copper loss in tailings as the amount of oil is decreased, in these series of experiments?

A. The tailing went quite constantly upward as the amount of oil per ton was reduced. In fact it went to the point that it represented a great big loss, an enormous loss.

Q. 199. What is the range of figures, just to get them plainly stated outside of this table—loss in tailing?

A. The loss in tailing for that period which we considered a normal period, from December 25th, 1916, to March 24, 1917, the average loss in pounds of copper per ton of tailings, was 2.40 pounds of copper per ton. On March 25th it was 4.82.

Q. 200. With 16 pounds of oil; is that what you mean?

A. Yes, with 16 pounds of oil.

Q. 201. Might as well state the amount so we know what the figure is related to.

A. On March 26th it was 5.56 with 15.84 pounds of oil used. On March 27th it was 4.98 with 16.33 pounds of oil. On March 28th it was 6.00 pounds of copper per ton with 16.41 pounds of oil per ton. On March 30th it was 11.78 pounds of copper per ton with
2673 10.63 pounds of oil used per ton. On March 31 it was 9.72 pounds of copper per ton with 10.33 pounds of oil per ton used. On April 1st it was 11.20 pounds of copper per ton with 5.16 pounds of oil used per ton, and on April 2nd, it was 25.54 pounds of copper per ton with 4.16 pounds of oil used per ton.

Q. 202. Does that last figure you read, a loss of 25.54 pounds of copper to the ton, represent any recovery at all? What were the headings here, about?—Unless the other side wants it I don't care about the actual figures but I should like to know what kind of material you were treating.

A. Yes. I can give you the actual figures. That was April 2nd.

Q. 203. April 2nd. The test marked "C" with a star.

A. On April 2nd the heading contained 7.14% copper. The tailing as shown on this exhibit 38 was 1.277% copper, and the con-

centrate 27.09% copper. The indicated extraction for that day was only 86.16%.

Q. 204. Now, do your notes enable you to give the same figures for that normal period or does that already appear in some of the tables we have in evidence?

A. Well, for that normal period—I haven't that figure for the normal period with me, I believe, right now. I can give you though—I can give it to you by months.

2674 Q. 205. Maybe you can compile it before you come back after recess and then you can give it to us for that whole period just for a basis of comparison. Now, I find a column here "Loss, Pounds of Copper per Ton." That is the column we have been talking about. The next column is, I take it, the loss per ton on 15 cent copper—that is what it says, the value I presume of the copper that is lost in each ton of ore treated.

A. Yes, this first set of figures, the loss per ton at 15, 20, 25 and 30 is the calculated total loss.

Q. 206. The value of the copper that goes into the tailings?

A. Yes, without any comparative—without any comparison being attempted. That is, under our normal period when the average copper in the tailings was .12, the loss in pounds of copper per ton was 2.40. Now, at 15 cents a pound for copper that is 36 cents per ton of tailings, that was lost.

Q. 207. Then I am correct, am I not, that these three columns, "Loss per ton, 15, 20, 25, 30"—four columns, that simply represents the value of metallic copper in the tailings under the different columns represented?

A. Yes.

Q. 208. Now, we have next here "abnormal loss per ton tailings."

A. Abnormal loss, pounds copper per ton tailings.

Q. 209. That is simply the weight of the copper in the
2675 tailings under these different conditions?

A. No, that is the abnormal loss; that is the difference.

Q. 210. How do you figure the abnormal loss?

A. Why, in this: we consider for that period covered, from December 25th, 1916, to March 24th, 1917, which we have considered a normal period for the purpose of comparison—the pounds of copper there, you will notice, loss in tailings—the pounds of copper per ton is 2.40. The corresponding figure on the next line, which is of date March 25th, is 4.82. Now that is the actual loss, 4.82, so we consider the abnormal loss the difference between that and the average loss of the normal period, which in this case would be 2.42.

Q. 211. The 2.42 in the abnormal loss column is arrived at by taking 2.4 from 4.82?

A. Yes.

Q. 212. Then here in this abnormal loss column, that represents the actual loss under each of these conditions, minus the 2.4 pounds that you consider a normal loss?

A. Yes, sir.

Q. 213. Therefore you have this abnormal loss?

A. Yes, sir.

Q. 214. Then in the next column, you have simply, I take it, computed the value of what you term the abnormal loss at different prices per pound, as stated at the head of the column?

2676 A. Well, we have computed the abnormal loss per ton under these varying conditions, and at the different prices, and also the abnormal loss per day, which is figured on the actual tonnage of the tailing which went out at that high figure.

Q. 215. Now, give us the range of loss that you mentioned how that figure per day at, will say, fifteen cent copper?

A. The abnormal loss per day at fifteen cent copper on the days on which we endeavored to use fifteen pounds of oil per ton, are as follows: On March 25th we actually used 16.17 pounds, and the abnormal loss is $300.93.

Q. 216. Per day?

A. On that day; that is the actual figure of the amount of tailing which went out with that abnormal amount of copper in it. On March 26th using 15.84 pounds of oil per ton of feed, the abnormal loss was on that day $394.84.

On March 27th, when 16.33 pounds of oil was used per ton of feed, the abnormal loss is $300.70.

On March 28th with 16.41 pounds of oil per ton of feed, the abnormal loss was $404.46.

On March 30th——

Q. 217. Mr. Conrads, you might state whether these losses kept on increasing, or whether they decreased, and what maximum and minimum they finally arrived at?

A. The loss increases almost constantly, with the reduction 2677 in the amount of oil used per ton of material treated; and on the last test which was conducted on April 2nd with 4.16 pounds of oil per ton of feed, the abnormal loss at 15 cent copper amounts to $2,912.17.

Q. 218. Now what would that amount to at thirty cent copper; just twice as much?

A. At thirty cent copper it would be $5,824.34 abnormal loss for the day.

Q. 219. Did you make such efforts as were possible to get the best results under all the different conditions recorded upon exhibit 38?

A. I did; I made a special effort to see that the best results were obtained that we could possibly obtain under the varying conditions.

Q. 220. What oil mixture did you use that day; does that appear on this tabulation?

A. Yes, I think so.

Q. 221. I don't believe it does.

A. Let us see. That is not on there, but we used a mixture of fifty per cent of Jones oil, 37½ per cent of Lyoth fuel oil.

Q. 222. What is that Lyoth oil?

A. It is a California fuel oil that we receive from Lyoth, California, and we give it that name—and also 12½ per cent of American creosote.

Q. 223. Is that a mixture that you have found suitable for use in operating with over twenty pounds per ton?

2678 A. That exact mixture we had not used for a very long period.

Q. 224. You have used it on other occasions than during these tests recorded in exhibit 38?

A. We used it on the day before, and one reason for not having used it for a longer period was on account of the difficulty we have had in getting a sufficient amount of Jones oil, that I was never able to work that down to get just exactly the combination that I am perfectly satisfied with, on account of not having ample supply of oil at all times for the purpose.

Q. 225. Do you know any facts to explain the reason these results deteriorated with the decrease of oil, whereas in some of your experience you have obtained good results with small amounts of oil?

A. Yes, we can get good results with small amounts of oil, very much smaller than this, and have done it, but with entirely different oils.

Q. 226. You think it is simply a question of the oil, the quantity to be used?

A. Yes. The conditions with the lower amounts of oil—we have not changed our conditions in the plant; the agitation of the feed, the flow of the pulp, or any of those conditions were not changed. And there is another thing that we never took into account in using the small amount of oil, that is, in that period covered by this exhibit 35—we never did take into account the circulating oil; we
2679 have no idea whether that figure given here is pounds of oil—that figure is pounds of new oil per ton.

Q. 227. As a matter of fact there was circulation in the system at that time?

A. Yes, at all times; that is our regular operation.

Q. 228. What effect would that have upon the amount of oil as stated in exhibit 35?

A. Well, it would increase it; to just exactly what amount it is impossible to say, but it is very probable that in some of those cases it might have gotten up to one per cent, or certainly over half of one per cent, which would be ten or twelve pounds, easily.

Whereupon an adjournment was taken until 2:00 P. M., Friday, April 20th, 1917.

Friday, April 20th, 1917—2:00 p. m.

Q. 229. Mr. Conrads, have you made any observation or do you know any facts that go to show what becomes of the oil that is used in these operations—more particularly with a large amount of oil?

A. I have nothing but my own observations; that is, I have made no definite calculations as to where it goes.

Q. 230. You mean no assays?

A. No assays.

Q. 230½. You have made some observations that throw some light on this question?

2680 A. Yes, I have.

Q. 231. Will you state what they are?

A. Since using the greater amount of oil I have noticed a considerably greater amount of froth which collects in the concentrate bins, or the bins into which the concentrate is run for drying, and from which it is shipped.

Q. 232. The completed concentrate?

A. Yes, the finished concentrate. As to the definite proportion of any assay, I could not say, but from observation I have noticed this froth has accumulated in some cases easily as much as a foot and a half deep on top of the bin.

Q. 233. How deep are these bins?

A. Those bins are fifteen by twenty-two and a half, each bin, in area.

Q. 234. They are that wide and that long?

A. Yes, that is the area of each individual bin; we have sixteen of these bins in service, concrete bins.

Q. 235. And you noticed this in the bins that were receiving concentrate which had large quantities of oil?

A. Well, our flotation concentrate does not go to the bins separately, but it is elevated into the general high grade concentrate launders from the entire plant.

Q. 236. And all the concentrates go together?

A. Yes, they flow on to the concentrate bins, and the distribution of the loading of those bins is simply governed as a matter of convenience, that is as to where the load goes at any particular time, depending on which bins are full, which bins we are loading
2681 out of and which are empty. Consequently there is an overflow, if the concentrate is going into one bin—before that bin is solid concentrate, there is quite a good deal of water and other material in general which overflows into the succeeding bins, and naturally that accumulates in different places.

Q. 237. And what did you notice in these bins?

A. I remember distinctly at one time I had one of the men that work there try to see if he could ascertain the depth of that froth on the concentrate bins,—on one of the bins, and he did not get to the bottom of it; he reached in probably—I should say to a depth of a foot and a half, at least that.

Q. 238. Did you ever do anything with this froth in the way of examining it or investigating it?

A. Yes, I attempted at one time to see if it would be possible or practicable to attempt the recovery of the oil from it.

Q. 239. How did you know there was oil in it?

A. Well, it is evident that it is a froth from the flotation plant; it is an oil froth; you can see the nature of it; and while there is more or less always, or always has been in my time at the plant—of course, during the period that I have been there they have been using the flotation process on the low grade stuff, and we always have a certain amount of that froth in evidence, but it is so much greater——

Q. 240. How does the quantity of that compare when you are using less than one per cent, say four or five pounds of oil, with the times when you are using twenty pounds?

2682 A. Well, the amount of froth with the greater amount of oil is greatly increased, there is a great deal more of it. I attempted to see if it were practicable to recover any oil from that, but after accumulating it for at least ten days or two weeks, I don't remember exactly, we attempted to break the froth down and draw the oil from it, and on close observation I could see that it was almost completely filled with very fine solid matter, probably concentrate and perhaps some silica; solid matter, mineral, probably and some fine silica for that matter—but with solid matter. It was very heavy in it, and I took some of that sample and tried to separate it in a centrifuge, a centrifugal machine. I did get some oil separated. These were not quantitative tests, simply observation. I did get some oil separated, and also quite an amount, relatively, of that fine solid matter. As I said before, with the fine mineral and perhaps silicious matter also,—from that the centrifuge would not make the separation, that is, separate out the solid matter from the oil.

Q. 241. Well, the liquid in which the solid matter was contained—was that all oil or was it oil and water or what?

A. Well, that had some water in it.

Q. 242. What?

A. That had some water in it. This froth itself, in taking a small sample like that, you naturally get some water with it.

Q. 243. Were you able to observe with certainty that there was oil present in the liquid which was separate from this froth which you spoke of?

2683 A. From the experiment with the centrifuge?

Q. 244. Yes.

A. Yes, sir.

Q. 245. Have you ever made any observations with regard to the effectiveness of the different oils which you have used in this mixture?

A. The general characteristics of the oils?

Q. 246. Their characteristics and their effectiveness in contributing to the result.

A. Yes. We have had that more or less forced upon us in failure to obtain sufficient supplies of oil that we would select in combination. For instance, we use generally, Jones oil, we use in our combination quite regularly, but at times our supply has been completely exhausted and we have been forced to use what oils we had on hand. For instance, that fuel oil, the Lyoth fuel oil. I have used that entirely alone; I have used it in combination with American creqsote and I have used various proportions of Jones oil, Lyoth fuel oil and American creosote and I have used also combination of Jones oil and Yaryan pine, small amounts of Yaryan pine as a frothing agent as the Jones oil has not sufficient frothing qualities.

Q. 247. Have you statements showing the results for individual days, separate from the time you began to use large quantities of oil?

A. Yes, sir.

Q. 248. I wish you would produce such statements.

(Witness produced the statements.)

Q. 249. These statements cover what months?

2684 A. I have one which covers a period from December 25th to 31st inclusive.

Q. 250. 1916?

A. 1916, yes.

Q. 251. And then what months in 1917?

A. The entire months of January and February and March and the month of April, from the first to the seventh inclusive.

Q. 252. These statements contain the data from which the summary statements that we have already had before us were compiled, do they not?

A. From which that monthly summary was compiled, yes, sir.

Q. 253. That really covers the same ground does it not?

A. Yes, sir.

Q. 254. Except that, naturally, they exhibit each day separate instead of in monthly summary?

A. Yes, sir.

Q. 255. So that what you have stated about the other exhibits containing the monthly statements, with regard to your having charge of the operations, will apply equally to these statements?

A. Absolutely, yes, sir.

Q. 256. And you therefore know them to be correct in the same sense that you knew the other ones to be correct?

A. Exactly.

Mr. Scott: I will then offer in evidence these statements,

2685 showing the results by days, the first entitled "Utah Copper Company, Magna Plant, Metallurgical Department, Composite Flotation Retreatment Plant Results, December 25th to 31st, 1916, inclusive.'

Mr. Garrison: Our standing objection, if your honor please.

The Court: Very well, overruled.

The statement is admitted in evidence and marked Defendant's Exhibit 39.

Mr. Scott: The next one entitled, "Utah Copper Company, Magna Plant, Metallurgical Department, Composite Flotation Retreatment Plant Results, Month of January, 1917."

Mr. Garrison: The standing objection.

The Court: Overruled.

The document was admitted in evidence and marked Defendant's Exhibit 40.

Mr. Scott: The next one entitled "Utah Copper Company, Magna Plant, Metallurgical Department, Composite Flotation Plant Results, Month of February, 1917."

Mr. Garrison: The same objection.

The Court: Overruled.

The statement was admitted in evidence and marked Defendant's Exhibit No. 41.

Mr. Scott: The next one is entitled: "Utah Copper Company, Magna Plant, Metallurgical Department, Composite Flotation Retreatment Plant Results, Month of March, 1917."

2686 Mr. Garrison: Same objection.

The Court: Overruled.

The statement was admitted in evidence and marked Defendant's Exhibit 42.

Mr. Scott: The next one is entitled "Utah Copper Company, Magna Plant, Metallurgical Department, Flotation Retreatment Plant Results, for the Period April 1 and 7, 1917, Inclusive."

Mr. Garrison: The same objection.

The Court: Overruled.

The statement was admitted in evidence and marked Defendant's Exhibit No. 43.

Mr. Scott: On these reports I will state that we only have two copies, but will have more made this evening, as soon as court adjourns, to supply the other side.

Mr. Garrison: Is there anything we can follow in the examination of the witness.

Mr. Scott: I am not going to examine him any further about them, except to find out if the same general plan was followed in the preparation of these statements as was followed in the monthly summary.

Q. 257. The same general plan was followed in compiling these daily statements as was followed in the monthly ones, was it not?

A. The same general plan, yes.

Q. 258. The only essential difference is that the data is set forth in 24 hour periods instead of averages for the month, is it not?

2687 A. Yes, sir. There is a further slight difference, about the only difference that I recall right now, between these various statements is that from December 25, 1916, to January 16, 1917, inclusive, no oil was credited from circulation. There was a circulating load carried but it was not taken into account. From January 17th to March 3d, inclusive, that circulating oil was taken as new oil.

Q. 259. Without making any allowance for the increased tonnage due to the solids in the middlings?

A. Yes, sir. From March 4 to 24 inclusive the circulating oil in excess of 20 pounds per ton of dry pulp in circulation was credited as new oil. Then immediately following that comes a period of these tests with various amounts of oil.

Q. 260. These are the tests upon the abnormal costs statement?

A. Yes, in which that is specified, when we credit as 15 pounds and 10 and 5, respectively.

Q. 261. And this brings the report down to the end of the period?

A. The report down to April 7th.

Q. 262. Mr. Conrads, before you leave the stand you might detach from your book the copy of these exhibits so that counsel for the

other side may have them to look at while cross examining you. You have copies of them in that book?

A. I have the copies, but I will have nothing to refer to.

Mr. Garrison: Has he copies besides these?

The Witness: I have my own file copy.

2688 Cross-examination.

By Mr. Williams:

X Q. 263. Going back to the operations from August, 1916, to and including December 24, 1916, I do not observe that the table, exhibit 35, gives any information as to the oils that were used. Can you supply that information generally?

A. I can supply it in detail, Mr. Williams, by reference to my notes—that is, I think I have quite sufficient detail.

X Q. 264. It wouldn't be a very long matter, would it?

A. If you care to refer to it by days. I haven't the monthly statement made up of the various days of the months, you see, comparison by a month, but I can get that data for you on any particular day or days.

Mr. Garrison: You can make out a table for us and furnish it to us, can't you?

A. I can, but it will require quite a great deal of time.

Mr. Garrison: It would require infinitely more time if we ask you question by question, day by day?

Mr. Scott: Will the stenographer please read the question?

(Question read as follows: "Going back to the operations from August, 1915, to and including December 24, 1916, I do not observe that the table, exhibit 35, gives any information as to the oils that were used. Can you supply that information generally?
2689 A. I can supply it in detail, Mr. Williams, by reference to my notes—that is, I think I have quite sufficient detail. Q. It wouldn't be a very long matter, would it.")

X Q. 265. Were frequent changes in the oil used during that period, or was there a comparative stability?

A. Generally a comparative stability. There were changes and trials of new combinations, etc., at times.

X Q. 266. Well, what in general were the oils that you used during that period?

A. That is referring to the period subsequent to August?

X Q. 267. From August, 1915, when you went to the plant, up to December 24th, 1916, when you changed to large quantities of oil?

A. I have this in a manner here which I think will go over that as you desire, Mr. Williams. In the month of August, 1915, Barrett creosote, Barrett No. 4, Jones oil, pine oil and No. 642—that is reconstructed pine oil. That was used on the first of the month.

X Q. 268. In what proportions?

A. We used 520 pounds of Barrett creosote, 645 pounds of Bar-

rett No. 4, 778 pounds of Jones oil, 197 pounds of pine oil, and 333 pounds of No. 642.

X Q. 269. That was the total for the month?

A. No, that was the first day of August.

X Q. 270. That was the total amount of oil used on that day?

A. On that day.

X Q. 271. Now what was the total tonnage of material treated on that day?

2690 A. On that day we treated for one section 224 tons, and for the other 324 tons, total 548 tons.

X Q. 272. Now, give me another typical day?

A. We changed them to Barrett creosote, Jones and pine oil on the second, and Barrett creosote, Jones and pine and No. 642 on the 3rd and 4th. There is a period from the 16th to the 31st we used Barrett No. 4, Lewis creosote, Jones oil, pine oil and No. 642.

X Q. 273. Give me the proportions on that day, first of the oil and then of the material, say the 24th?

A. August 24th we used 431 pounds of Barrett No. 4, 949 pounds of Jones, 319 pounds of Lewis, 291 pounds of pine, 555 pounds of No. 642.

X Q. 274. What tonnage did you treat on that day?

A. The tonnage for one section was 226 and for the other 322; that makes 548 total.

X Q. 275. Now, can you run along and tell when any very substantial change was made?

A. Take the month of September I think we used the same combination.

X Q. 276. Then never mind.

A. That was used from the first to the 6th, the 21st to the 24th, and the 28th to the 30th.

X Q. 277. Then in October was there any substantial change?

A. It is essentially the same, Mr. Williams; we used Jones, Lewis Creo, Barrett 4 and 642.

X Q. 278. Then we will run along in 1916 and take it about the middle of 1916 and see what you were using?

2691 A. When would you like?

X Q. 279. August, 1916, if you were running regularly then?

A. Yes. In August, 1916, we used Jones oil, American creosote, and Weaste, which is another creosote oil, and the trade name that we received it under is Weaste. That was used from the 1st to the 10th inclusive.

X Q. 280. And the amount for each day?

A. What day would you like; that was used from the 1st to the 10th.

X Q. 281. Say the 5th?

A. On the 5th we used 2,000 pounds of Jones oil, 666 pounds of American creosote and 666 pounds of Weaste oil.

X Q. 282. And the tonnage of material treated on that day?

A. The tonnage was 935 tons of heading.

X Q. 283. Total?

A. Yes.

X Q. 284. Now, suppose we come back to December 24th, the last day of the series. There was no change made then; you were running regularly then, about as you had before?

A. There were changes at times; as I said before we have not been able at all times—that is, we have changed our combinations according to the various oils. We have used, for instance, Barrett No. 4, Weaste and Jones, and we have used Lewis creosote and Jones oil and so forth, such things as that.

2692 X Q. 285. I see that the average for the month in pounds of oil per ton, for the month of December is 3.83, and let us see now if on the last day, December 24th, you were running about the average; you were not getting ready for the change or anything like that?

A. Well, on December 24th we started to use the increased amount in the afternoon, and the only reason that it was not included here is because the 25th was the first entire day that we used the increased amount.

X Q. 286. Then you had better take about the 15th of December?

A. All right, sir. On the 15th of December, 1916, we used 1,922 pounds of Jones oil, 1,704 pounds of American creosote, making a total of 3,626 pounds, and we treated 970 tons.

X Q. 287. Now, when, in December, commencing on the 25th, did you settle down to normal conditions. You started to use this large amount of oil, and of course I assume it took you a little while to get the plant settled; about when did that happen?

A. Well, it was not so much getting the plant settled, Mr. Williams, as it was being able to gauge that increased flow of oil accurately; that was the particular difficulty. It was about the 30th when we got that sufficiently under control to be able to hold it as closely, or fairly closely to what we wanted.

X Q. 288. I see that on the 31st of December your original feed was 20.72 pounds to the ton; is that right?

2693 A. That is right.

X Q. 289. Now I would like you to give me the amount of the respective oils; you have given their percentages in the table, but give me the amount of oil that you fed on that day, as to the respective oils?

A. On that day we used 14,806 pounds of Jones oil, and 779 pounds of Yaryan pine.

X Q. 290. And on that day you used 11 cells; what does that mean; did you use 11 circulating cells? You say "the number of cells circulating."

A. By referring to the diagram you will see that that means that 5 cells were producing finished concentrates, and 11 were producing middlings, which were returned to the circulating feed.

X Q. 291. Now, on that day, this 20.72 pounds per ton was the original feed of oil, was it?

A. Yes, sir, that is new oil per ton.

X Q. 292. And does this table show what you have spoken of as the circulating oil?

A. No, sir, it does not. If you remember, I mentioned that during this period we took no account of the circulating oil.

X Q. 293. Now, when will I find a day when you took account of the circulating oil?

A. Just refer to your month of January please.

X Q. 294. Somewhere about the middle of January, is that right?

A. January 17th.

2694 X Q. 295. Was the plant running continuously from January 17th on to the end of the month?

A. Yes.

X Q. 296. You did not stop to make any experiments or you did not alter the condition, you were running on normal conditions?

A. Yes. Now we had circulation before that; we had actually a circulating load, but we did not take it into account and we did not determine the amount of oil; that was not any change in operation, it was simply a change in the method of accounting, and accounting for that circulating oil, which had not been taken into account before.

X Q. 297. Now, will you mark on your sketch the point at which you took out the material for the purpose of getting the measurement of that circulating oil; just mark it on your sketch, exhibit 37?

A. Right here, where we took the sample from which is determined the oil in circulation; that is, the oil which is returned in that circulating load.

X Q. 298. That is somewhere in the sludge tank?

A. No, sir; the launder comes in above the sludge tank, right above it, and empties directly into it, and we got our sample right at this point, at the mouth of that launder.

X Q. 299. That is, before the launder dumps its load into the tank?

A. No, as the material leaves the launder going into the tank, we cut the stream where it is entirely free from the launder.

2695 We do not take it in the launder.

X Q. 300. That is you take it as it is falling down from the launder to the tank?

A. As it is discharged into the tank. We take our sample there for the percentage of oil, and for the percentage of solids in the feed. Now, as a matter of convenience we take the feed—that is the tonnage sample of the circulating feed—before it gets here, because it is really a very inconvenient place to get on top of that tank and take it, so we plug or shut off the feed there.

X Q. 301. In the launder?

A. In the launder.

X Q. 302. That is before it enters the tank?

A. We put a gate in the launder, and we have a six inch hole, and we allow that to run until the full flow is carried, and we have been sure to see that that hole is made large enough that there will be no retarding, that it is ample to take the entire flow, and we let that run until the stream is steady and we see there is no accumula-

tion in the launder, then we take a time sample, taking the entire feed, and we weigh that, and that gives us the total weight of the sample, of course, for a given definite period. We get our solid sample here, indicating the sample to determine the percentage of solids, and the percentage of solids is derived from that sample, from that we calculate the tonnage of feed for twenty-four hours,
2696 knowing the total amount of feed for a given length of time.

X Q. 303. Will you mark an "A" at the point where you measure your tonnage?

A. Of the circulating load. How would it be to put a cross there and indicate on the side?

X Q. 304. Put an "X" at the point in the launder and run a leader from it outside?

A. Now how do I mark it?

X Q. 305. Mark it with a big "A." Now, the other point that you have described is simply the overflow, the water falls from the launder?

A. It is simply the stream after leaving the mouth of the launder as it discharges into the sludge tank.

X Q. 306. That sludge tank is it ever full to overflowing?

A. No, I have never seen the sludge tank full; that is, it is perfectly clean, a clean fall; that is, it does not interfere in getting the sample.

X Q. 307. And how deep is the sludge tank, about?

A. The sludge tank is—I will tell you exactly in a minute. Eight feet diameter by ten feet deep.

X Q. 308. What is it that maintains in the tank a circulation such as prevents sediments?

A. There is a continuous discharge from the bottom of the tank, the flow going in at the top, the discharge being drawn off from the bottom, I should say, would prevent that as much as anything else.

X Q. 309. You do not have any stirrers of any kind inside of the sludge tank?

2697 A. No. There was at one time some air pipes put in simply to prevent any accumulation there, but that doesn't bother any, any accumulation of sediment in the bottom of the sludge tank.

X Q. 310. Now, what goes into that sludge tank is the new feed and the return middlings?

A. The circulating load from the return cells.

X Q. 311. And the new feed?

A. And the new feed, yes, sir.

X Q. 312. Nothing else goes into it?

A. No, sir.

X Q. 313. And what comes out of it is what?

A. Just exactly what goes into it.

X Q. 314. Well, it is the feed of the flotation plant?

A. Yes; yes, sir.

X Q. 315. That is to say, everything that goes in there, goes out into the feed of the flotation plant?

A. Yes. There is the new, original feed coming in; there is the

circulating load coming at another launder. From the bottom we tap that mixture of new feed and circulating load.

X Q. 316. What is your habit as to taking these samples out; how frequently during the day and for what period?

A. These samples are taken at hourly intervals, regularly.

X Q. 317. And for how long a period?

A. They are taken for a period depending on the amount of the flow. We have a large tub into which we tap that sample.
2698 When that return flow is extremely heavy we can not get it for quite as long a time as when it is a lighter flow. Our endeavor is to get as large a sample as possible. Generally speaking, though, we will take a 15 second sample, sometimes a 20.

X Q. 318. Is it an automatic sampler?

A. No; no, sir.

X Q. 319. A man times it, or a boy?

A. As I explained to you, we plug that launder; we put a gate in the launder to stop the flow, and at the same time pull the plug from the hole in the bottom of the launder, which, by the way, is very close to this gate so that there can be no accumulation in the same; the hole is amply large to take the full flow and we allow that to run until we are quite sure that the normal flow is coming, and then we cut our tub under and there is a stop watch to take the exact time.

X Q. 320. Now what does that circulating load consist of?

A. The circulating load consists of the material that is overflowed from the Spitzkastens of the cells which are not producing a finished concentrate.

X Q. 321. That is the froth?

A. Froth and more or less of the pulp and water.

X Q. 322. That is to say, your overflow is such a free overflow that water goes with the froth?

A. We have froth removers pulling that over, and in
2699 pulling that froth there is a certain amount of water accompanies the pulp.

X Q. 323. And that is the material which is in this circulating load, the froth, the water, and whatever goes with it as an overflow through these machines?

A. That overflow is run over from those cells which are not making a finished concentrate.

X Q. 324. Take January 26th. On that day you computed as your total pounds of oil per ton, 20.17, while the oil that you fed into the plant was 14.32 pounds per ton. Is that right?

A. That is the figure which appears. I am quite sure it is right.

X Q. 325. Now, as I understand what these figures represent is the material that flows from the sludge tank into the flotation plant head added to it, just after it left the sludge tank?

A. Oil in the proportion of 14.32 pounds per ton.

X Q. 326. The dry material is the pulp; is that right?

A. Of dry material in the original feed.

X Q. 327. And that dry material fed to the plant was 1003 tons, is that right?

A. On the 26th?

X Q. 328. On the 26th?

A. I so have it, yes.

X Q. 329. So that on that day you fed into the plant 1003
2700 dry tons of material to be treated and you fed into the plant oil at the rate of 14.32 pounds to the ton of that material and according to your computation the pulp that went into the flotation machine contained 20.17 pounds of oil to the ton of dry material that went into the flotation machine?

A. To the ton of dry material of the original feed, not including any tonnage or solid material which was returned in the circulating load.

X Q. 330. Which, of course, would have reduced that?

A. Yes, sir.

X Q. 331. That is to say, in this calculation you do not take into account all dry material that came around in the circulating load?

A. No, as explained before, Mr. Williams, this is a period during which we did not take into account the dry material, nor attempt to satisfy that with oil, in the circulating load.

X Q. 332. Well, now, let's get into some time when you did all of that, had all of your refinements.

A. I beg your pardon, Mr. Williams, just a minute. You asked me to mark this exhibit No. 37, which I did, with the point indicated where we take that tonnage sample, and I have indicated here with the letter "A." Now you wished another indication there where we took the sample for determining the percentage of solids.

X Q. 333. I think your sketch sufficiently indicates the
2701 end of the launder, but if you will just draw a line across it, then your description that you took it as it overflowed into the tank, is sufficient.

A. All right, sir.

X Q. 334. Now where will we find a computation in which you had all your refinements of calculation?

A. You will find that from the 4th of March on.

X Q. 335. Take March 19.

A. Yes, sir.

X Q. 336. On that day, according to the showing of your table, exhibit 42, the total pounds of oil per ton entering the flotation machine was 20.27; is that right?

A. Yes, sir.

X Q. 337. And that is the pounds per ton in relation to all of the new material that went into the flotation machine; is that right?

A. That is on what day, Mr. Williams, please?

X Q. 338. March 19th.

A. That is the total pounds of oil per ton of original feed, after satisfying the dry tonnage in the circulating load with 20 pounds of oil per ton.

X Q. 339. Therefore, according to your calculation a portion slightly in excess of 20 pounds of oil to the ton of material entered the flotation machines; is that right?

A. As I explained, there was 20 pounds of oil per ton allowed from

the amount of oil in the circulating feed, 20 pounds of that oil per ton of the dry pulp contained in the circulating feed. The
2702 balance we considered excess oil.

X Q. 340. Well, let us find out how much oil there was per ton of material in the circulating feed; does your table show that in one of the numerous columns?

A. I think we can find that in one of the numerous columns.

X Q. 341. I find the figure 66.23 which seems to be under that heading, "Pounds Oil Per Ton in Circulation." Is that *is*, under the general heading "Circulation Feed"?

A. Yes.

X Q. 342. That is circulation feed?

A. Yes, sir.

X Q. 343. That material?

A. Yes.

X Q. 344. Concentrate not rich enough to take away. Contained 66.23 pounds of oil per ton of material?

A. Dry material.

X Q. 345. Of dry material?

A. Yes, sir.

X Q. 346. And pounds of new oil per ton of original feed was 12.38?

A. Yes, sir.

X Q. 347. Now, assuming that the pulp which flowed into the flotation machine contained material which was a mixture of mineral and gangue and contained oil and the relationship be-
2703 tween the two was such that there were 20.27 pounds of oil per ton of new material——

A. (Interrupting.) Of original feed—excuse me.

X Q. 348. Well, as I am endeavoring to grasp these figures and I don't live with them, as you do, you were assured, you said, that all the material that went in there, had oil, an amount of oil with it, that there was a proportion of 20 pounds and a little more, per ton of material. That, you said, you were sure of.

A. Let me, if you will—Perhaps if I can explain and clarify the matter,——

X Q. 349. I will be pleased to have you do so.

A. All right, sir, I will endeavor to. You understand what makes up our circulating load.

X Q. 350. Yes, it is made up of the concentrate that is not good enough to send away, and some water, and of course with the concentrate there is some gangue and with the concentrate there is a great deal of oil, that is what it is made up of is it not?

A. In general it is the overflow from the Spitzkasten of the cells which are not producing a finished concentrate. Now, we determine the amount of oil in that circulating load. We get that in pounds. We also determine the dry tonnage of pulp in that circulating load. Then multiply the dry tonnage in that circulating load by 20 which gives us the number of pounds of oil which we must allow
2704 for that material which is entering the head of the machine, in addition to the new feed. Now, we have satisfied that with

20 pounds of oil. We then have in this case—generally have—the excess. If we should have a deficit we make that up with new oil. Generally we have a surplus.

X Q. 351. In figures?

A. In oil.

X Q. 352. As shown by figures?

A. Certainly, that is the only means we have.

X Q. 353. It might be sticking to the concentrates, of course, but you have an excess in figures?

A. We have that oil; we find that out.

X Q. 354. Yes.

A. We first satisfy the dry tonnage in the circulating feed with its 20 pounds, and the excess—that is added to the total amount of new oil that is put in, and this total amount is divided by the original tonnage of new feed which gives us this figure here.

X Q. 355. The figure 20.27?

A. Whatever that is—20.27.

X Q. 356. Is this excess free oil?

A. Now you have asked me a question which I am sure that I can not say.

X Q. 357. Well, you don't know?

A. We know that that is oil—We determine that and find that the oil is in there, but as to just what condition it all is, or how much enters—how much of it is free, how much of it is
2705 emulsified in the pulp, how much of it is coating mineral substances, that I can not say.

X Q. 358. Wouldn't your analysis enable you to detect that, if you took this material and separated the water?

A. There might be a determination of that made. We have not made it.

X Q. 359. You have not made any determination of it?

A. No, sir.

X Q. 359½. The oil might be all adhered to the concentrate, or the mineral or a part of it attached to the mineral and a part of it running around in the water, or a part of it on the gangue that was there? Is that right?

A. As to what condition it is, Mr. Williams, I do not know. I have never made a determination of the state or condition of it in that circulating feed.

The Court: He asks if it could be one of these things he mentions. Could it be, in your opinion?

A. It could be.

By Mr. Williams:

X Q. 360. Now, all of this oil that goes in with the circulating feed has been through at least as many of the flotation machines as are supplying a concentrate which is taken away? That is true, isn't it?

A. No, not necessarily because it might come off of the 5th
2706 cell and not been through the remaining eleven.

X Q. 361. My question is: All of this oil has been through

at least as many of these machines as are supplying a concentrate, a finished concentrate? That is right, is it not?

A. Yes. It is not taken off until it passes that portion of the machine which is making finished concentrates.

X Q. 362. You might tell me what number of cells on that day were producing finished concentrates and what number of cells were producing circulating feed, as you call it.

A. That was on the 19th of March, I believe, was it not?

X Q. 363. Yes, 19th.

A. I have here on my notation on that day's results, "Concentrates from 6, 7, 8, 9 and 10 cells to bins. Product from balance of cells to circulation; tailings to waste."

X Q. 364. That number that you have there, does that show that machines 1, 2, 3, 4 and 5 were in the circuit or not?

A. What numbering do you refer to?

X Q. 365. You said 6 to 10 were producing finished concentrates. How about 1 to 6?

A. Well, that is the total number of cells, does not refer to the numbers.

X Q. 366. That is the total number?

2707 A. That is the number of cells.

X Q. 367. One to six?

A. That would be six cells.

X Q. 368. And one to ten?

A. Would be ten cells.

X Q. 369. Out of the 16?

A. And that is varied according to the conditions.

X Q. 370. That is to say, if the observer notices that the froth in No. 7 is not quite as good as it ought to be, he switches it out.

A. That is left to the operator. For instance if he has six cells for a period of time that are making a finished concentrate, conditions change so that the sixth cell is not making a grade of concentrate which in his estimation is sufficiently clean, he cuts in that cell to the circulating load and out of the high grade.

X Q. 371. So that at some time that day machines 1 to 10 were supplying a finished concentrate?

A. Yes.

X Q. 372. And the other machines, 11 to 16, were supplying the circulating load?

A. Yes.

X Q. 373. Now, I thought that your table showed—but perhaps you can supply it—what was the condition of the feed to the first emulsifier of the flotation plant as to the proportion of oil to solids?

A. That would be—I haven't that figure, Mr. Williams. That would be the total tonnage—that is, the average proportion

2708 would be the total tonnage of that day which was 1031, was it not?

X Q. 374. Yes.

A. That would be 1031 tons of new feed with 20.27 pounds of oil per ton, plus the dry tonnage in circulation, 176 tons, with its oil at 20 pounds per ton. We don't carry that figure in that way.

X Q. 375. I would just like to have that figure. It doesn't seem to me it is a very difficult calculation.

A. No, I can make it. I believe you will find that is right, if I have not made a mistake, 20.23.

X Q. 376. Twenty and twenty-three hundredths pounds of oil to the ton of dry material in the feed to the flotation machine which enter the first emulsifier, is that right?

A. Yes.

X Q. 377. Now that material goes through these three emulsifiers in series and there is no loss of material at all, nothing leaves it, it just goes right through one after the other, is that right?

A. There is nothing discharged from that, that is, except from 1 to 6 in the series.

X Q. 378. There is no loss of material?

A. No, sir.

X Q. 379. Nothing taken off?

A. No, sir.

X Q. 380. That is, it enters the first flotation machine?

A. Yes, sir.

2709 X Q. 381. Now, what takes place in that first flotation machine?

A. The material is agitated in the cell and it rises by the centrifugal force of the propellers and overflows under a light baffle into the Spitzkasten.

X Q. 382. One on each side?

A. One on each side, yes.

X Q. 383. And have you given the speed of the rotation?

A. 570 revolutions per minute.

X Q. 384. And the diameter of the impellers or agitators?

A. The lower impeller I think is 14½ inches exactly.

X Q. 385. And the upper impeller is a little larger?

A. Twenty inches.

X Q. 386. And alongside of the lower part of the machine and extending on up to the top of the impeller there are vertical baffles?

A. Yes.

X Q. 387. So that there is a terrific agitation in that machine?

A. Yes, there is.

X Q. 388. And the material is thrown out at the top of the machine?

A. Yes.

X Q. 389. And drops into a sort of launder or chamber?

A. Under the motor. The motor stands on its own base just above that cell, vertically, and in which this impeller revolves. The

2710 material is forced up to the top and overflows into the Spitzkastens on the side.

X Q. 390. And when it gets into the Spitzkastens what happens — the froth, the concentrate bearing froth which accumulates at the top?

A. That is removed by the froth removers, blades.

X Q. 391. Slowly revolving blades.

A. Paddles that are driven by a revolving shaft and simply re-

move or assist to remove the material in the overflow into the Spitzkastens and from the spitzkastens" or cells into the circulating launder.

X Q. 392. And that froth is being constantly removed in the operation of the machine and that is the finished froth of machine No. 1?

A. Yes; the head cells make a finished concentrate.

X Q. 393. How much oil is removed in that concentrate?

A. I have never determined that.

X Q. 394. A considerable amount of oil goes with the concentrate there, doesn't there?

A. There is quite a great deal of oil goes with the concentrate.

X Q. 395. Now, from this first machine you have first an overflow of froth carrying with it a considerable amount of oil, and then you have the tailing, haven't you? which goes into the second machine?

A. Yes, that flows between—that flows through the di-
2711 vision between the cells it is provided with a gate which is open practically at the point of the bottom of this Spitzkasten, and which is raised and lowered to regulate the flow through the machine.

X Q. 396. And all the material that that second machine receives is what flows to it as the tailing from the first machine, is that right?

A. Yes.

X Q. 397. And that material has been denuded of the oil by reason of the fact that the concentrate carrying a great amount of oil has flowed off, isn't that right?

A. Denuded, no, but some, some has been removed.

X Q. 398. A good deal of it has been removed?

A. There is some removed; there is quite a good deal left.

X Q. 399. And in fact you have got down now below twenty pounds to the ton of the material treated, haven't you?

A. I have never made a determination of that at that particular part of the machine.

X Q. 400. In view of the fact that you were so close to the line when you started, 20.23 and in view of the fact that you have taken off a great deal of that oil, it is reasonable to assume that you have lowered now to a condition where you have less than twenty pounds of oil to the ton of material, isn't it?

A. Well, at that point it may be that we have less than twenty pounds to the ton. We have more than twenty to start
2712 with, and that is where we make our calculations.

X Q. 401. Now, from machine No. 1 we have got this material which has lost some of its oil into machine No. 2. Now, the same thing happens in there as happened in No. 1?

A. The same proceeding, yes.

X Q. 402. It is only the tailings of machine No. 2 that get into machine No. 3 from No. 2?

A. The tailing from No. 2, or what you might consider the tailing.

X Q. 403. It is what is left after that concentrate with the considerable amount of oil has overflowed?

A. Yes.

X Q. 404. And on this day at some time there were ten machines in series, each discharging a considerable amount of concentrate, and a considerable amount of oil, and the amount of oil was being reduced in every step generally; that is right, isn't it?

A. Yes, naturally.

X Q. 405. Every step down reduces the oil?

A. You know there is a certain amount of oil that goes off with the concentrate from each cell.

X Q. 406. So that down at machine No. 10, the proportion of oil to dry material must have been very much below twenty pounds to the ton?

A. It probably was, yes. It doubtless was.

X Q. 407. Then let us take machine No. 11; that would have a still lower amount of oil, and machine No. 11 operated just the same as the others, didn't it?

2713 A. On the same principle.

X Q. 408. Only now this concentrate froth was not good enough to use, and it was sent back to be put through the machine again?

A. Yes.

X Q. 409. An operation that is generally referred to as a cleaning operation, although in this particular instance it may be given a different name, but substantially a cleaning operation.

Mr. Scott: Are you asking a question, Mr. Williams?

Mr. Williams: I think so; I think that is an interrogation.

A. Well, it might be considered so. We do not regard it as a cleaning operation. Generally in referring to a cleaning operation we refer to a machine which is making—that is, for instance, like our flotation machines are concentrating and cleaning a low grade concentrate.

X Q. 410. That is, if you put it through another machine you would call it a cleaning operation?

A. Yes, one is called a rougher and another a cleaning machine.

X Q. 411. But through the same machine you don't call it that?

A. Well, that would be a circulating load, or the term middling is often applied to it.

X Q. 412. But as a matter of fact that froth was subjected to retreatment in this instance to the same machine head; that

2714 froth from No. 11 did not go to the finished concentrate, but went back and was subjected to retreatment in the same machine?

A. In the same machine, yes.

X Q. 413. And then from No. 11 to No. 12, you performed the same operation, did you not, still losing a proportion of the oil?

A. Yes.

X Q. 414. And so when you got down to No. 16, it seems to me that there must have been a very small amount of oil; you agree with that, don't you?

A. There must have been a greatly reduced amount, because there

has been a great deal of it removed from the upper cells, or the cells above it.

X Q. 415. Did you ever measure that?

A. No, sir, I have never determined those figures, except as I have stated in the general circulating load. Of course, you know, measuring that total accumulation from the returning cells.

X Q. 416. That only gives on this day, as I understand it, an indication of what a large amount of oil is being taken off by the concentrates, doesn't it; it gives us that?

A. Well, you see here that there were 12,768 pounds of new oil added; there were 11,656 pounds of oil in circulation.

X Q. 417. That is 11,656 pounds were in the rougher concentrates, the low grade concentrates that overflowed from the last machines of the series?

A. It was the froth that was overflowed from the cells which were returning and circulating;—the last machines of the series, yes.

2715 X Q. 418. Now, have you got an assay showing the value of the concentrates which was treated as circulating load?

A. An assay of that dry product?

X Q. 419. Yes.

A. No, I have not.

X Q. 420. Your only determination was of the amount of oil in it?

A. The percentage of solids, the amount of oil and the tonnage.

(Whereupon a recess was taken.)

X Q. 421. In this table of proceedings during the month of March, 1917, defendant's exhibit 42, I observe that there are three days during which all of the 16 cells produced finished concentrate; that is right, is it not?

A. Three days, yes, sir.

X Q. 422. Of course on those days you did not have any circulating load?

A. None whatever.

X Q. 423. Now, if the oil in the circulating load is all attached to the concentrates, you would not be adding any oil to the new feed by carrying this circulating load containing concentrates with oil attached to it into the plant, would you?

A. If all of the oil in the circulating feed was attached to sulphide—what is the question?

X Q. 424. Then you would not be adding any oil to the
2716 new feed by putting in this sulphide with oil attached to it, would you?

A. Yes, indeed. That is still oil, Mr. Williams. Whether it be attached to mineral particles or not, that is still oil, isn't it?

X Q. 425. Have you any experience upon which you can say that that oil leaves the concentrate or sulphide to which it was attached, and attaches itself to the new and unoiled sulphide that has been fed in there?

A. No, I did not mean to convey that impression; I do not mean to say that. However, whether that oil is all attached to the sulphide

particles or not, it is still oil which is returned in that circulating load.

X Q. 426. Now, in your operations before you changed to twenty pounds or more of oil to the ton, as you have represented it to be, or believe it to be, you did not give any attention to this matter of the circulating feed, did you?

A. As to the calculation or the computation of the amount of oil, no.

X Q. 427. You never computed it at all?

A. We always carried the circulating load, but as to its entering into our calculations as to the amount of oil which it carried and the amount of tonnage returned or the like of that, that was not computed and did not enter into our calculations. We simply calculated from the original tonnage of new feed and new oil.

The Court:

X Q. 428. This circulating load, is it ground additionally anywhere in the circuits?

2717 A. No, sir.

X Q. 429. What is the object of it anyway?

A. Well, it is a concentrate—that is, it is removed in the same manner that the concentrates are removed from those cells making the finished concentrates.

X Q. 430. Why doesn't it go out in the first circuit instead of coming back the second time?

A. Well, in the first circuit the first cells are producing a concentrate which is rich in mineral and of sufficient grade so that it can be shipped directly, it is a finished product. Now, we get down to a dividing line, as it were—we get down to a point where that froth will contain silicious matter and probably middling, which is mineral attached to gangue rock.

X Q. 431. What I mean to ask is why that second time around these sulphides that are in the circulating load are more likely to come out in a finished product than the first time around, or is there any reason?

A. Well, it may be this, that there may be particles in there that are attached to silicious matter, or that might be involved or connected in some way with fine silica or silicates and go over in that mass, and in that abrasion they probably would clean and become separated, that would be one reason.

X Q. 432. All right. I wanted to understand if there was any second grinding or anything. I was of the impression that there was not.

A. No, sir, there is not.

Mr. Williams:

X Q. 433. I think, responding to the line of thought of the
2718 court, that what actually occurs is a repetition of the very violent agitation; that is to say, these concentrates that are not good enough, they are sent back in the circulating load to be again subjected to the agitation; that is what they are subjected to?

A. The same series, and they go in back with the fresh oil and into the original condition—that is, back to the head of the machine, and are subjected the second time and perhaps the third time; we cannot tell how many times—to that same operation.

X Q. 434. Now, these are all Janney machines, aren't they?

A. Yes, the Janney type of machine.

X Q. 435. Are they of the mechanical type.

A. Yes.

X Q. 436. And do they include the compressed air chamber?

A. No, we have no air chamber; this is the mechanical type straight.

X Q. 437. Now, you gave an illustration, an example of a crusher which received a certain amount of material for crushing, and in which there was a provision for the return of the over sized material and sending it back through the crusher. Now, if that was a roll crusher, everything that went through it was necessarily reduced to the distance between the rolls, isn't that right?

A. Well, to the distance between the rolls, but not at which they are set for grinding, because there is a provision in those
2719 crushers which allows, for instance, if a piece of iron or steel gets in there, that it can go through it, for they give to a certain extent.

X Q. 438. But the material that is crushed is not supposed to have any operation in separating the crusher rolls, is it?

A. There is a spring which allows—by which that is taken care of, which is provided for that reason.

X Q. 439. In that example all of this material, this over size which is sent back and through the rolls again, is material that has been already crushed, although not crushed as fine as desirable?

A. It has not been crushed down to the size that is wanted, and it is not necessarily—naturally you would suppose that the greater percentage of it has been crushed, but there is a possibility that in its original form, if there were some small particles there that were over size from the standpoint of the screen or the size required to be crushed to—there might be particles which go down in that stream and pass through without being crushed. Of course the majority of it would be crushed to a greater or less degree.

X Q. 440. Well, now, in this example you take a crusher that I think crushes ten——

A. You take a specific example?

X Q. 441. I think you said 100 tons. 100 tons per——

A. (Interrupting.) Per day. I don't remember. I believe I said 100 tons per day.

X Q. 442. Well, now, that crusher crushes 100 tons per day, does it not?

2720 A. Its original feed is 100 tons per day.

X Q. 443. And the material that it crushes is 100 tons of material per day isn't it?

A. It crushes very much more than 100 tons of material per day.

X Q. 444. Well, what does it discharge, 100 tons per day?

A It discharges more than that; it discharges that originally, also the circulating load.

X Q. 445. Plus that portion of the circulating load that is discharged on that day; is that right?

A. No, not technically speaking. That is, that is not exactly the point. It receives 100 tons of material, is put in, of ore. The screening plant, under balanced conditions, that finished product which passes the screen will be 100 tons per day. That is, if the conditions balance.

X Q. 446. And balanced conditions are the conditions that are—You adjust to attain, are they not?

A. Certainly.

X Q. 447. And so, in the flotation machines you would have balanced conditions, or you would be thrown out of balance, isn't that right?

A. We endeavor to keep balanced conditions.

X Q. 448. Well, don't you have to keep balanced conditions, for any considerable run?

A. You refer directly to the manner of circulation load, and its influence?

2721 X Q. 449. Yes.

A. That, Mr. Williams—There is a variation in that. That is, in the amount, as you will see by these sheets, in the amount of dry feed in that circulating load. I have not been able to determine a definite percentage or a definite balance nor have I been able to see if that goes up in tonnage or up in oil or down in either one, that it necessarily upsets us.

X Q. 450. Well, it doesn't, does it, when you are running normally, you are not upset by any great increment, and increase of oil?

A. Well, I should say that we don't normally have any great increment, that is—or such increment.

X Q. 451. Now, in regard to these oil determinations that have appeared on your tables. Mr. Janney described a method of determination. Can that be taken as fairly representative of what you use?

A. We do not use exactly the same method of determination.

X Q. 452. Can you tell me about how you determine the amount of oil?

A. Yes, sir. The sample, which I refer to as being taken at regular intervals for that purpose, is determined by shifts, 8 hour shifts. The pulp is thoroughly mixed and a portion is weighed and placed in an 8 ounce flask. Petroleum ether is added to the flask and the flask is corked and agitated, and after that agitation the flask is allowed to stand for a few minutes until there is a clear separation between the solvent and the pulp. Now, the solvent dissolves

2722 practically all of the oil and also holds considerable material in suspension. Water is added to the flask to bring up the level, until the solvent and the oil and this mineral which is floating, up, right up into the upper part of the neck of it. That is decanted into a beaker. The beaker is put on a hot plate and the contents allowed to boil for a few minutes. Then it is removed, allowed to settle; there

is a sharp, or clear separation noted of this suspended material, and the solvent. The solvent is then decanted through a filter and more petroleum ether is added to the residue remaining in the beaker. It is again boiled, it is allowed to settle and again decanted, and that operation is repeated time after time until the petroleum ether shows no coloration. The solvent is put into a four ounce Erlenmeyer flask, placed on a hot plate and the petroleum ether is driven off. When about three or four cc. remain the flask is placed in an air bath heated below 200 degrees centigrade—that is, not above 200 degrees centigrade, until the petroleum ether is entirely driven off, and the flask is cooled and weighed. We have had a little difficulty in that way. The grade of petroleum ether which we have received has some very high fractions in it, and that we have corrected by rectifying and taking only the more volatile or lighter portions. We have also used the method of sulphuric ether and when we use that, on account of its low boiling point, we finished the operation
2723 in a water bath, water heated to about boiling, and we finished the operation finally, after most of the ether is driven off, we disconnect it from the top and insert a tube with warm air and pass it through until it removes the last trace of that ether.

X Q. 453. That describes all of the oil determination operations?

A. Yes, that is—Then of course calculations are made from the portion which is weighed originally and the amount of oil which is obtained from them, the calculation is made as to the amount in the total circulating feed, etc.

X Q. 454. Now, you said something about making experiments in a centrifugal machine, the recovery of oil from the concentrates?

A. Yes, sir.

X Q. 455. Did you get anything of practical value out of it?

A. No, sir.

X Q. 456. You do not recover any of your oil from concentrates?

A. I made that one attempt and I found that that froth which we collected from the concentrate bins was practically entirely loaded with very fine mineral, and even after making a separation, or as much of a separation as I could, there still remained what was quite apparent in treating in a centrifuge when it would separate out, that very fine material was quite apparent and we decided that it would not be practical to try to make the separation or recovery of
2724 oil in that way.

X Q. 457. And in no part of your plant do you make any recovery, do you, of the oil that you put in?

A. Recovery, that is separation?

X Q. 458. Yes.

A. And a clean recovery of oil?

X Q. 459. Yes.

A. No, sir.

X Q. 460. That is to say, all the oil that goes into your flotation plant goes out either with the concentrate or with the tailings?

A. Yes, sir.

X Q. 461. Now, have you made any determination of the amount of oil that goes out with the tailings?

A. No. I referred to that earlier. I have never made any, except just observations on it, but as to a definite determination, I have not.

X Q. 462. One of the oils that you referred to this morning was reconstructed pine oil. Can you describe that a little better?

A. Well, it is a pine oil which is treated with sulphur and a distillation made in this way, you see with about—I wouldn't say exactly, but I think 5 to 10% by weight of sulphur is added in this treatment.

X Q. 463. And the oil thus treated is what kind of pine oil?

A. We call it reconstructed pine oil.

2725 X Q. 464. I mean the oil that you start with?

A. That is a pine oil.

X Q. 465. Like the Yaryan oil?

A. Yes.

X Q. 466. Or is it the Yaryan pine?

A. I would not be positive as to whether Yaryan pine—Yes, that I am quite sure has been reconstructed, but it is a similar product.

The Court: Do you know how much oil goes through your concentrator?

A. I don't know, that is, I never assayed that. The only thing, as I say, your honor, is from observation only as to the attempted reclamation of it, which was a failure, or found to be impracticable on account of the great amount of fine material carried in this froth, in the difficulty in separating it, or the practical impossibility—at least we decided it was not a commercial possibility or there was no money to be saved or made by it.

X Q. 467. I notice that in your tables you have a heading, "Reagent, Total Pounds and Pounds per Ton." What is that reagent, or what are those reagents?

A. That reagent is one which we make up at the plant of sulphur and caustic soda and lime and water.

X Q. 468. Did you hear Mr. Janney's description of that and its characteristics, which he gave yesterday?

A. Yes, sir, I was here when he described it.

X Q. 469. And that is the material which you are talking of?

2726 A. We make it ourselves and it differs in strength from what is made at the Arthur plant. We don't make it in exactly the same proportion.

X Q. 470. Did you use that reagent prior to December 24th?

A. 1916?

X Q. 471. 1916.

A. Oh, yes, yes we have used that at all of the time that I have been at the plant.

X Q. 472. Don't you give that a name, that reagent?

A. We call it Calura.

X Q. 473. Do your tables show the proportion of solids to water, or pulp?

A. As it enters the machine?

X Q. 474. Yes.

A. Yes, sir.

X Q. 475. Then your tables show that?

A. I am quite sure that every one does; I think so. I guess it is not on this one.

X Q. 476. Have you any general practice?

A. I can give you that—I thought it was on those sheets.

X Q. 477. Well, have you any general practice?

A. I can give you the exact figures by months or over long periods. Referring to exhibit No. 35 the percentage of solids for that entire period averaged 36.001. On exhibit 36, covering the period from December 25th, 1916, to April 7, 1917, inclusive, the average percent. of solid was 31.276.

2727 X Q. 478. Now, I asked Mr. Janney for specimens of the various oils and he is going to get them. Can you supplement his work by seeing that we are supplied with specimens of the oils that you have used?

A. I can.

X Q. 479. Would you be willing to do so?

A. Oh, yes, I am perfectly willing to do so, Mr. Williams, the only thing is that I am not sure that we can get specimens of all the oils that we have used at the plant. Now, with that exception only. As to the oils that we have recently used, of course we have them and I will be very glad to get them for you.

X Q. 480. The ore at your plant is not the same as at the Arthur plant is it—is it or is it not?

A. It comes from the same mine.

X Q. 481. Comes from the same mine?

A. Same property, yes.

X Q. 482. So that the specimen that Mr. Janney will give will give substantially the same thing?

A. I should think that they would be all that would be needed. Of course our ore does not assay the same on any particular day. There are certain variations, but it comes from the same mine, the same property and is essentially the same thing.

Mr. Garrison: There is no purpose of sending some to Magna and others to Arthur—that would be a mere chance?

A. To my knowledge there is practically no difference. There is a certain variation of course but then it is essentially the same ore.

2728 Mr. Williams: Subject to the reservation that I have made before, the cross-examination of this witness is suspended.

Redirect examination.

By Mr. Scott:

R. Q. 483. Mr. Conrads, why is it that you now take account of the circulating oil?

A. The circulating oil as I look at it, is a factor which should be considered because that is an oil entering the head of the machine. In order to determine your exact proportions you should have that.

R. Q. 484. The exact proportion of oil present in the apparatus?

A. Yes. Of oil to the solids entering the machine. Formerly, as I stated before, we took no account of this although it was present. Now that really gives an erroneous condition. We have a certain amount of new oil but that is not the total amount of oil entering the head of the machine.

R. Q. 485. That is, this statement of operations down to December 24, 1916, the statement of the amount of oil added is an understatement or overstatement of the actual amount of oil present in the process?

A. That would be under at all times. The circulating load will always carry some oil, and as I stated, I believe this morning, that that might be—it is hard to say just exactly what that would amount to, but we have had our circulating oil built up to pass the
2729 amount or even more than that, of the new oil, so that that figure is, I should say, considerably under the total amount of oil entering the head of the machine.

R. Q. 486. Are you acquainted with any facts that would explain why it is that in the later cells of the series you are not able to get off a marketable or at least to get good concentrate, while in the first cell you do?

A. There may be a number of factors entering into that. There are several possibilities or easy possibilities. There may be a considerable amount of free mineral which is more or less protected from oils, either by an oxidized film, a partial oxidization of these particles, or it may be some envelope or protection by free silicious material, for instance, that it would not be cleaned and that the consecutive operations, the grinding and abrasion in passing through the cells and the continuous agitation would tend to free them, or brighten up the surface of it, free it from any protecting envelope of silicious material, for instance, or an oxidized coating, and eventually make it susceptible or wetable as sulphide.

R. Q. 487. In the operation of other concentrating apparatus, such as the tables and vanners etc., is there anything analogous to the circulating load in your flotation machine?

A. There is a practice—It is not universally adopted, but there is a practice which is used in some places of returning a middling product from a concentrating table directly back onto the
2730 table. That is, your finished concentrate is delivered to its launder. The middling streak or portion as it comes from the table is laundered to some sort of an elevator which will elevate it to return it to be fed over again to the same table. Now, we have a circulating condition in connection with our retreatment plant. There is a middling product from the tables, and also the tailings from the tables which treat the first, second and third spigots of the retreatment plant classifier. That tailing is retreated in vanners. The vanners do not make a finished concentrate. They make a finished tailing and this concentrate is returned in back to the general low grade, and goes through the circuit again. There is very commonly that middling product, or that product which is between a

finished tailing or a finished concentrate which must be taken—which must be circulated and taken care of.

R. Q. 488. Did you make any of these later assays yourself personally?

A. Personally I do not.

R. Q. 489. Are you a chemist qualified to do such things?

A. Well, my work has been such, Mr. Scott, that I have not had time to do it, and I have gotten out of it.

R. Q. 490. Where did you get this information which you read upon cross-examination regarding the method of the oil determination?

A. That is our method as we use it at the Magna plant.

2731 R. Q. 491. Originated or practiced by your oil chemist?

A. Yes. That is a thing—while I don't run the assays for the oil I have the supervision of that and the dictation, and I have to go into those details and pass upon those things.

R. Q. 492. As I have understood your testimony it is your universal practice to get your finished concentrate solely from the first cells of the series where the maximum oil is present?

A. Yes; our finished concentrate comes entirely from the first cells of the series.

R. Q. 493. And the lower members of the series, where, if anywhere, the oil supply is depleted, is where you get the middling from which is returned to the head of the machine?

A. Yes; the oil is in much less quantity there from the fact that a great deal of it has been removed with the concentrate from the upper cells, the first cells.

Witness excused.

2732 EDWARD W. ENGLEMAN, called as a witness in behalf of the defendant, being first duly sworn, testified as follows:

Direct examination.

By Mr. Scott:

Q. 1. State your full name?

A. Edward William Engleman.

Q. 2. What is your occupation?

A. Flotation foreman, Ray Consolidated Copper Company.

Q. 3. How long have you held that position?

A. Three years.

Q. 4. Have you had experience in metallurgical work prior to your engagement by the Ray Consolidated?

A. I did.

Q. 5. You might briefly state your education and experience?

A. You mean college course and everything?

Q. 6. Yes.

A. I graduated from the Missouri School of Mines in 1911, with the degree of mining engineer, and spent two and a half years with the Utah Copper Company at Garfield, Utah, in their experimental

department, and spent practically half a year with the Butte Dary Musu Mining Company, as mill superintendent in Deer Lodge, and the last three years I have been down at the Ray Consolidated Copper Company as flotation foreman.

2733 Q. 7. When did you first have experience with flotation concentration?

A. At the Arthur plant of the Utah Copper Company, which was in the latter part—about the middle of the year, I guess, in 1913.

Q. 8. At the Hayden plant of the Ray Consolidated, what sort of material was treated by flotation?

A. We treat what we call the vanner low grade concentrate and the slime vanner tailings.

Q. 9. Are these flotation operations under your direct charge?

A. They are.

Q. 10. You are responsible for the conduct of the flotation department?

A. I am.

Q. 11. In these operations what amounts of oil have you used approximately?

Mr. Garrison: Our standing objection, of course, goes to this testimony.

The Court: Yes.

A. That is from the beginning?

Q. 12. From the beginning, yes, in a general way?

A. Well, the last quarter—well, we started flotation operations on a commercial scale at the Ray Consolidated plant about the first of October, 1914. That quarter we used 4.31 pounds of oil per ton. In 1915 for the total year we used 4.41 pounds of oil per ton. In 1916 for the total year we used 3.36 pounds per ton. In

2734 1917, beginning January 1st, and for the month of January, we used 20.02, for February 18.77, and for March, 21.19.

Q. 13. Have you a statement setting forth the details of these flotation operations during the period you have referred to?

A. Why, you mean the period of 1917?

Q. 14. I mean from 1914 down to 1917, in March?

A. Yes, I have a quarterly report.

Q. 15. Does your statement represent operations carried on under your direction and supervision?

A. Yes, sir.

Q 16. And you have knowledge of its correctness?

A. Yes, sir.

Q. 17. The operations were conducted, were they, and the figures compiled in the regular course of business at the Ray Consolidated Company?

A. They were.

Mr. Scott: I will now offer this report in evidence that the witness speaks of.

Report marked defendant's Exhibit 44 for identification.

Mr. Garrison: Are you going to supplement this with details, Mr. Scott, of the daily operations?

Mr. Scott: He has some further details that he has not tabulated. I think he can answer as to them.

2735 By Mr. Garrison:

Q. 18. Did you prepare this actual table that you have here?
A. It was prepared under my supervision.
Q. 19. Did you dictate the contents?
A. No.
Q. 20. Who did?
A. The statistician does all the compiling of results that we obtain.
Q. 21. Did you furnish him with the figures?
A. No.

Mr. Garrison: I don't see how this paper is relevant at all or competent.

A. Because all these figures——

Mr. Garrison: I was speaking to the court. This witness says that he did not prepare this but that it was done by the statistician.

By Mr. Scott:

Q. 22. The work was compiled under your supervision, was it not?
A. Absolutely.
Q. 23. Everything was done under your direction, both in the practical operation and in the clerical work of compiling the record?
A. Yes, sir.

Mr. Scott: It appears that this report was compiled in the way that all reports of this kind necessarily are.

The Court: It looks so.

2736 By Mr. Garrison:

Q. 24. Where did the statistician get the material he used, if you did not furnish it to him?
A. He got it from the foremen that were working for me at the flotation plant. They report each day and furnish the results.
Q. 25. Furnish them to you or to him?
A. They furnish them to me, and I furnish them to him.
Q. 26. Have you the original material all here?
A. I have all the original material for 1917. I have not the original material for all these.
Q. 27. Have you the original material for any of these?
A. For the previous——
Q. 28. What have you for these? I use the same term you did?
A. No, I have not.
Q. 29. You have no material here except for the year 1917—original material?
A. Original material.

Q. 30. Will you be able to answer questions from any records with respect to any other year than the year 1917?

A. Yes, sir.

Q. 31. From what source will you get the information to answer those questions?

A. Well, I know that these figures are right.

Q. 32. You misunderstand me. I understand that this
2737 paper is a compilation made up by a statistician from reports in your possession; is that correct?

A. Yes, sir.

Q. 33. You said with respect to the year 1917 that you were equipped here now so that you can consult those original records or copies of them and testify from them; is that correct?

A. I can.

Q. 34. And you say that as to the years previous to that you are not so equipped, is that correct?

A. I haven't the records with me. I can send for them and get them.

Q. 35. Yes. I am not criticising you. I am trying to find out the facts.

Mr. Garrison: I still think this paper is incompetent. It seems to have been made by a statistician from reports that are not here. This gentleman did not make it up, and they are only in lump details anyway.

The Court: To what extent does it differ from the others that you have already allowed to go in?

Mr. Garrison: Because the gentleman who made the others said that they made them up, and had the material from which they were made, and they were supplemented in each instance with these daily things that are really useful in cross examination. We cannot cross examine from this.

The Court: Was it the testimony as to the other reports that the witness himself made the exhibits from data furnished to
2738 him?

Mr. Garrison: Yes, sir.

The Court: And in this case the data was furnished, but he did not make the exhibit himself.

Mr. Garrison: Yes, sir.

The Court: It is only one step further.

Mr .Garrison: You do not understand my objection, your honor.

The Court: I understand, yes. I think possibly you have refrained very much from urging technicalities as to this.

Mr. Garrison: Absolutely, your honor. We do not want to stand on technicalities. If this gentleman will get the daily reports before we cross examine him, from which this is made up, we have no objection, but this is only in lumps, and we have no means of cross examining the witness. If you use 100 tons one day and one ton the next day, the average does not mean anything.

Mr. Kremer: Mr. Engleman will furnish those.

Mr. Garrison: I have no objection to its being admitted if they will follow it up with papers that will give that detail.

The Court: Do you want to have the witness testify now.

Mr. Garrison: I would prefer to have him testify when he gets his data so we can cross examine him.

The Court: I think you had better get it first.

2739 Mr. Garrison: I shall object in any event to the note on this exhibit.

Mr. Kremer: That note says that the circulating load would increase the amount to over twenty pounds to the ton. I think that should be eliminated. I will mark it out with a pencil.

Mr. Garrison: Mr. Williams is willing to have him go on.

Mr. Kremer: We will eliminate the statement on this exhibit that is objected to.

Mr. Garrison: It is understood then, if this examination proceeds that we will not be required to cross examine until the other papers arrive.

The Court: That is, this data that has to be sent for—what is that?

Mr. Scott: The daily details, I understand, Judge Garrison wants, for the years 1914, 1915 and 1916.

By Mr. Scott:

Q. 36. Is that in tabulated form—those details?

A. It is not. We would have to bring all our records from the office up here, and it is a very difficult thing to do for three years back.

Q. 37. They are not compiled in form to bring them up?

A. No, they are not.

Q. 38. They are simply the memorandum books and the report books of all kinds?

A. Yes, and daily assay sheets and oil sheets. Each day has a separate oil sheet and a separate assay sheet, and they would

2740 have to be collected for three years previous and brought up separately—that is, each one separately from the other.

Mr. Scott: Until we find out whether it is practicable to get all these records here, I don't know that there is any objection in examining Mr. Engleman. The other witnesses had their records in such form that they could be transported readily, but it seems that these records are not compiled.

Mr. Kremer: We might simplify it by offering him as only to the 1917 report, and if we see fit to recall him as to the other years, we can do that after *the* gets his data.

Mr. Scott: Well, I will confine the examination to the year 1917, and we will have this part of the compilation in such shape that it can be offered. We will have that done after the adjournment.

Mr. Scott:

Q. Have you directed the flotation operations on a practical scale with upwards of twenty pounds of oil per ton of ore?

A. Yes, sir.

Q. 39. During what period?
A. During the months of January, February and March, 1917.

Mr. Scott: It is understood that we withdraw this exhibit now. It has not been admitted and therefore I prefer to withdraw it altogether.
Mr. Garrison: It has been admitted.
Mr. Scott: No, it was not admitted.

2741 Q. 40. How great a tonnage have you treated in the flotation process with upwards of twenty pounds of oil to the ton?
A. We treated for the month of March 11,063 tons, using 21.19 pounds of oil to the ton.
Q. 41. And in other months how much did you treat?
A. In January we treated 9,300 tons with 20.02 pounds; in February we treated 8,550 tons with 18.77 pounds. The total for the quarter was 28,913 tons, and the average oil added per ton was 20.10.
Q. Now, in the month of January was that oil added, inclusive of the circulating oil or not?
A. The oil added in the month of January was new oil.
Q. 42. That is all that is taken account of in the figures that you gave, 20.02 pounds per ton?
A. Yes, sir.
Q. 43. You simply calculated the circulating oil altogether?
A. Yes.
Q. 44. And was there circulation during the month of January?
A. Yes.
Q. 45. You might briefly describe the flotation plant, and I think it would be well to make a sketch of it so that we may understand the procedure?
A. I have a small sketch here.
Q. 46. It would be a little better if we kept these of uniform size. You may prepare a sketch.
A. (Witness draws.)

2742 Mr. Garrison: He has a sketch prepared.
Mr. Scott: If you have one, you may use it. I did not understand that.

A. I have one. Our feed for this plant comes from the retreating plant classifier from the mill, which is what we call our low grade vanner concentrate, and the feed comes to this sump, and we add the oil at that sump, and a centrifugal pump pumps it up into the back, or into a small box feeding two emulsifiers in series. The discharge from those two emulsifiers goes to five Janney mechanical flotation cells in multiple; each cell is fed separately from the other; we make a finished concentrate from each cell. The tailing from each cell goes to a launder and is combined as one product and from these five Janney mechanical flotation machines in series—these five are in series—the concentrate product from the five in series we call middling or circulating load, and that goes back to the sump where it joins the original feed, and then back to the

emulsifier, and back through the first five machines in multiple. The tailing from the last series cell goes to waste.

Mr. Scott: I will offer this sketch in evidence.

Sketch admitted in evidence without objection and marked Defendant's Exhibit 45.

Mr. Scott:

Q. 47. About how fine is this material that is treated in your flotation plant?

A. The screen analysis of the headings to the plant are 2.84 on a forty-eight mesh; 3.28 on a 65 mesh; 9.91 on a 100 mesh;
2743 12.93 on a 150 mesh; 12.50 on a 200 mesh; 12.93 on a 280 mesh; 45.61 through a 280 mesh.

Q. 48. Is that the only flotation system you have, the one you have represented in this sketch, exhibit 45?

A. Treating this product, yes, sir.

Q. 49. Have you a flotation plant for treating another kind of product?

A. Yes, sir.

Q. 50. What is that other product?

A. We have a flotation plant where we treat our slime vanner tailings.

Q. 51. Is that a still finer material than this that you have given the analysis of?

A. Very much finer, yes, sir.

Q. 52. Without giving the whole analysis, can you give in a general way how fine that material is?

A. Yes, sir; 2.22 per cent. on a 65 mesh, and 69.05 through a 280 mesh.

The Court:

Q. What is that, 280 holes to the square inch?

A. Yes, sir, 280 holes to the inch.

Mr. Scott: I think it is 280 to the lineal inch.

Q. 53. Will you state, Mr. Engleman, the manner in which you estimate the circulating oil in these operations that have been conducted since January 1st with a comparatively large amount of oil?

A. Well, during the month of January we did not determine the circulating oil. It was during the months of February and March.

2744 Q. 54. February, yes, I looked at this table wrong.

A. We employed an expert oil chemist to spend two months or two months and a half with us and he determined the percentage of oil in our circulating load, and his reports were submitted to me.

Q. 55. What can you say as to the relation of the results obtained since January 1 with substantially 20 pounds of oil per ton, and the results obtained prior to January 1, with the smaller amount of oil then used?

Mr. Garrison: We object, if the court pleases, if they are not going to give us the benefit of an examination as to the sources of his information.

Mr. Scott: We are proposing to examine the witness as to his knowledge. We have offered this table in evidence and it has been objected to, but the witness knows the figures prior to January first and I am asking him to testify about them.

The Court: If he knows. The objection will be completed if you had not completed it, if you desire to urge it.

Mr. Garrison: My objection is this: He is now going to ask him with respect to results prior to 1917 and he has told us that he hasn't here anything from which he can testify as to the results prior to that year; but what he does have, is not the source of his original memory; it is all based upon data and that data he does not have here today. It is quite obvious that any answer that he gives us now will not be based upon any data which is probative. As I said a moment ago, I have not been technical; I have not insisted upon these gentlemen bringing their original records here;
2745 we have trusted to the character of their witnesses not to impose records upon us—or character of records—that were false.

The Court: The only question is whether he has information aside from the documents or having refreshed it originally from the documents.

Mr. Garrison: It may be that our objection would be captious if we did not refer to the answer in reference to this document to tell us results; but surely our objection is well founded when he has no independent knowledge. The only knowledge he has is what he obtained from some foreman.

The Court: I understand they were asking him if he knew of his own knowledge.

Mr. Garrison: No, he distinctly told us that he knows nothing whatever of his own knowledge. He only knows what was reported to him by these foremen and other men in the mill. He does not pretend to say that he stood and saw the operation from beginning to end. The objection is not captious. It is meritorious.

The Court: Well, if this witness knows anything of his own knowledge, not what someone reported to him or someone told him, he can testify; but otherwise, in the face of the objection the court will be obliged to sustain it.

(Question read as follows: "Q. What can you say as to the relation of the results obtained since January 1, with substantially 20 pounds of oil per ton, and the results obtained prior to January 1, with the smaller amount of oil then used.")

2746 The Court: You are asking for results apparently made up from reports and records made and kept by others. I don't think it is competent. I can not understand on what theory it would be competent.

Mr. Scott: The witness in all probability has had access to these records here.

The Court: Yes, he has read the records.

Mr. Scott: He has refreshed his recollection and he undoubtedly possesses that recollection still, and having that knowledge now, whether by prior memory or by having refreshed his recollection from original data, it seems to me he is entitled to testify to it.

The Court: They have waived the fact that a large part of it is hearsay, but they insist, if it goes in, they must have the records themselves. I think if they are going to waive that part of it, it is waived on a condition, if they are going to waive the strict letter of the law. No, the objection will be sustained.

Mr. Kremer: We will qualify this; we will bring in these records and defer the examination upon them until they are here.

Whereupon an adjournment was taken until Monday, April 23rd, at 10:00 o'clock a. m.

2747 Monday, April 23d, 1917.

The Court: Gentlemen, are you ready to proceed with the case on trial?

Mr. Williams: I hand your honor a slip from the Patent Office, which the Patent Office attaches to every copy of the patent, which is a copy of the disclaimer.

Mr. Kremer: That is not offered in evidence, is it?

Mr. Williams: It is a copy—it has been sent to us by the Patent Office with instructions to annex it to the patent.

Mr. Kremer: Are you offering it in evidence?

Mr. Williams: Yes, we offer it in evidence.

Mr. Kremer: To that we object for the reason that the disclaimer is no disclaimer in point of law, for the reason that said disclaimer, instead of relinquishing, extends the scope of the patent For the further reason that the Supreme Court of the United States having declared claims 9, 10 and 11 of the patent invalid, a disclaimer can not be made by the patentee conditionally, but the claims having been declared invalid, they must be disclaimed in toto. For the further reason that upon the face of the record the plaintiffs and those owning the patent have been guilty of unreasonable neglect and delay in filing the alleged disclaimer. For the further reason that the plaintiffs and complainants and those owning the patent have failed to comply with the sections of the Revised Statutes of the United States providing when and where and in what manner a disclaimer must be filed. For the further reason that the document here presented is not of a character purporting authority by certification or otherwise, such as to entitle it to admission in evidence in a case of this sort.

2748

Mr. Williams: I further offer in evidence a letter from the Patent Office, addressed to me, signed by the chief clerk of the Patent Office, with whose signature I am very familiar, although I am not testifying, but I presume Mr. Scott will acknowledge that—as follows:

"Herewith please find printed copy of subject matter of disclaimer filed by you in Letters Patent No. 835,120, granted November 6th, 1906, to be attached to the original Letters Patent."

Mr. Kremer: That is objected to as incompetent, irrelevant and immaterial, correspondence between counsel and the Patent Office.

Mr. Williams: I will put it in the position occupied by it in every patent sent out by the Patent Office.

The Court: I think it is a mere matter of official detail, the disclaimer itself having been filed, because that was all that was required to give it whatever effect it is entitled to. The objections will be overruled.

Mr. Kremer: Both objections?

The Court: Yes, both objections.

Mr. Kremer: We desire to note an exception to both rulings of the court.

2749 The Court: Exception may be noted.

Mr. Williams: I ask leave to withdraw the original letter in view of the fact that the subject matter has been read upon the record.

The Court: Very well. Are you ready to proceed, Mr. Scott?

Mr. Scott: I have made some progress, and I think we will now be able to get through about the end of next week, which will finish everything but the plaintiff's closing, and that will enable us to finish in about three weeks. I think it will be best to withdraw the witness who was on the stand Friday until all the objections can be remedied, and we can examine him in full.

The Court: Very well.

Mr. Scott: For that reason I would like to call Mr. Dosenbach to the stand this morning.

The Court: Very well. Call your witness.

BEN H. DOSENBACH, a witness for defendant, after being duly sworn, testified as follows:

Direct examination.

By Mr. Scott:

Q. 1. State your full name.

A. Ben H. Dosenbach.

Q. 2. What is your occupation.

A. My occupation is that of metallurgist and engineer.

2750 Q. 3. What has been your training and experience in that line?

A. For approximately the past four years I have been engaged in metallurgical problems and the operation of flotation plants and have been particularly engaged during that time in the flotation of ores. Previous to that time I was engaged in milling—in the general practice of milling through the various departments of the Utah Copper Company and the Ray Consolidated Copper Company at Hayden, Arizona.

Q. 4. Where did you receive your education in the line of metallurgy?

A. I received my education at the Missouri School of Mines at Rolla, Missouri, and also at the University of California at Berkeley, California, having received a degree in mining engineering, and having specialized in metallurgy.

Q. 5. When did you first become occupied in investigating or practicing the flotation process?

A. It was in the year 1913, in April and May.

Q. 6. And for what employer, or for your own interest, was it?

A. I was employed by the Butte Superior Copper Company, now the Butte Superior Mining Company.

Q. 7. Did you have any experience with flotation before your employment with the Butte & Superior Company?

A. I did not.

Q. 8. Did you make any investigation along the line of flotation before your employment by the Butte & Superior Copper Company?

2751 A. I did not.

Q. 9. And what was your first work in connection with flotation?

A. My first work at that time consisted in observing the action of various oils and reagents that had been used in flotation, in the laboratory and also in an operating plant.

Q. 10. And what laboratory and operating plant was that?

A. The laboratory of the Butte Superior Copper Company.

Q. 11. And what ores?

A. The ores of the Butte Superior Copper Company.

Q. 12. And what apparatus did you use at that time?

A. The apparatus that was in use at that time was what was known as the slide machine.

Q. 13. Have you used other experimental apparatus since?

A. I have used various forms of apparatus since that time.

Q. 14. What was the nature of your employment, that is, your actual position or duties, when you were first employed by the Butte & Superior Company?

A. I was employed as metallurgist.

Q. 15. And you have held that position continuously up to the present time?

A. I have.

2752 Q. 16. And in that position what particular duties are you called on to perform?

A. Well, my duties consist of looking after any metallurgical problem that comes up, any new developments that arise in the metallurgical connection with the operation of the concentrate end of the mill and also the flotation plant, particularly the flotation section of the mill at the Butte Superior plant.

Q. 17. Did the Butte & Superior Company have a flotation plant in operation at the time you entered their employ?

A. They did.

Q. 18. Will you please give that date, just when it was you entered their employ?

A. To the best of my recollection it was in April or May, and I am fairly positive it was in April.

Q. 19. 1913?

A. 1913. I can look up the records and find the exact date, but I think it was in April, 1913.

Q. 20. About the time the Hyde case was argued in this court, was it not?

A. It was at the time the Hyde case was argued in this court because I was a spectator.

Q. 21. Well, describe generally the form of apparatus and the manner of its operation that was in place at the Butte & Superior mill when you came here, flotation apparatus?

A. In the mill?

Q. 22. Well, wherever it was?

A. At the time I came here and went to work for the Butte
2753 & Superior Copper Company, there was a flotation plant consisting of two roughers. The second day that I was here the plant was dismantled, and as far as I am concerned I can only speak of the flotation plant as it existed after starting up, having been shut down for a period of six days for remodeling.

Q. 23. You cannot, from your own knowledge, describe the plant as it existed before it was dismantled?

A. I cannot, in all details, no.

Q. 24. Well, if you have any personal knowledge about it you may describe it as far as that extends. How many cells were there, if you know, and matters of that sort?

A. There were, if I remember rightly, upon my first day at the Butte & Superior plant two roughers consisting of four spitzkastens and nine or eleven agitating cells to each rougher, and there was a cleaner in operation.

Q. 25. There was a cleaner?

A. Yes. That is as far as I can go as to the plant before it was remodeled. After the plant had been remodeled I was engaged—and during the remodeling of it, I was engaged by the Butte — Superior Copper Company so I can testify to that part of it.

Q. 26. And what was the nature of the remodeled plant?

A. The nature of the remodeling was to change the driving mechanism for one thing, to a gear drive; also to increase the agitation of the impellers; increase the speed of the impellers so
2754 as to cause a greater agitation; also to add additional agitating cells, and rearrangement of the flow sheet, where by a flotation plant was former *constituting* of two roughers, having eleven agitating cells each, and four Spitzkastens each.

Q. 27. The extra agitating cells, I take it, received the pulp and agitated it before that went to the cells having the spitzkasten?

A. Exactly so. There was also a cleaner which consisted of four agitating cells and four Spitzkasten, such cleaner making a final concentrate.

Q. 28. Was this plant, after being so remodeled, the final plant that remained in operation for a considerable length of time?

A. It did for a short length of time, possibly two or three months, when other changes were made and have continually been made up to the present time.

Q. 29. Can you remember the reason for the change being made in this remodeled plant?

A. The changes were principally to increase the recovery and produce a higher grade of concentrate.

Q. 30. Can you state from memory or by refreshing your memory how efficient the operation was when this remodeled plant started to work?

A. I think it would be advisable to look at some notes in order to give the exact figures, because I can't remember that far back as to such things.

Q. 31. If you have these notes in tabulated form you might produce them so that we can have them before us. Or, if you tabulated part of the result?

2755 A. I have tabulated the results at that time, and for a time later.

Mr. Garrison: Did I understand there was an unanswered question?

The Court: I think he has answered.

Mr. Scott:

Q. 32. Have you copies of this tabulation ready or aren't they ready yet.

A. I have them ready.

Q. 33. Are these the copies you refer to?

A. I don't see the copies that you refer to, Mr. Scott, in this list.

Q. 34. Well, have you any tabulation covering the period since you were in the employ of the company?

A. I have.

Q. 35. But there is no copy of it then?

A. There is a notation there which I don't understand.

Q. 36. If you have your copy of that tabulation, Mr. Dosenbach, that you can refresh your memory from, I would like you to state the nature of the results when this remodeled machine was first started up.

Mr. Garrison: I object, if your honor please. There is nothing in the testimony of this witness which justifies him in testifying from personal knowledge to the results of the operations of the machinery of the Butte & Superior plant from some indefinite date in April, 1913, for however long a period the question is assumed to cover. We have sufficient knowledge from the previous evidence on this subject that a gentleman occupying the position of metallurgist

2756 and engineer does not have personal knowledge of these matters; he has such knowledge as is furnished to him by his assistants or underlings, who are the ones who actually do the probative

thing. It may be probative in this case as to how much oil was used at a particular time; it may be the determining factor in the entire case, and it does not require elaborate discussion that that factor should not be put in evidence by one who has and can have no knowledge about the matter, by the nature of the case, excepting such as is conveyed from other and original sources of information. If that is not clear already with respect to this particular witness, I crave the right to cross examine before he be permitted to proceed with his original testimony.

Mr. Scott: Mr. Garrison may cross examine if he wishes. I do not know what he is going to cross examine about. I put the question as to the details of this operation. In regard to the objection I might say that Mr. Dosenbach was in charge of these operations, and that he will testify from the official and original records of the company, and the only reason that I at all hesitate in attempting to satisfy counsel's demands in advance is the great amount of time that will be consumed. We have all these people accessible, the samplers, the assayers, the chemists, and the men who turned the oil on, and we can probably have several hundred employes here who performed each of these individual operations, if necessary. But the witness will testify as to operations under his immediate charge, re-
2757 freshing his memory as to detail from the official records kept under his charge, and as far as he uses tabulations he will, upon request, furnish the figures and verify them from the original records, which are too voluminous to bring into the court room.

The Court: You may cross-examine if you wish. Do you wish to proceed?

Mr. Garrison: Yes, sir.

The Court: You may do so and see how his knowledge is derived.

Cross-examination.

By Mr. Garrison:

X Q. 37. When you are asked to give the results of the operations of flotation plants with a view of stating whether they were good or bad or indifferent, upon what factors do you base your judgment?

A. I was asked to give the results of a flotation plant.

(Last question read.)

Mr. Kremer: We object to this for the reason that at this time it is improper cross-examination. If the witness is being interrogated to ascertain whether he is competent to testify to the tables, the question is improper.

Mr. Garrison: I have not the benefit of having the table before me.

The Court: If you don't qualify your witness by your own examination or by this cross-examination, the objection will have to be sustained. Your objection is overruled.

2758 Mr. Kremer: We are ready to bring all these witnesses here if counsel desires them. There are four or five hundred of them up there ready to come down, but it seems to me as a matter of law that if a man testifies to a condition which exists in an opera-

tion over which he has supervision, that that meets the requirement of law as to what was done in the operation. It is not necessary to produce every man that turned on a tap.

The Court: Your objection will be overruled, Mr. Kremer. Counsel may proceed with the cross-examination and we will rule later on the other objection.

X Q. 38. (Last question read again.)

A. I base my judgment as regards the Butte & Superior flotation plant upon my actual knowledge of conditions which existed in the plant at that time, as my presence was there each day, and I was in direct touch with the operation of the plant. I was in charge of the plant; the men were working the plant under my direction, and I knew what the conditions were throughout the plant at that time.

X Q. 39. Now please answer the question; I want to know on what factor you base your judgment.

The Court: Well, I think he has answered that.

Mr. Garrison: He is stating now, if I may interrupt your honor, the reasons which are going to induce him, as I understand it, to express a judgment. I did not ask him that; I ask you what
2759 factor, whether the grade of the concentrate, or the amount of the recovery——

The Court: You had better make that a little clearer.

Mr. Garrison: I thought the witness understood that, as a professional man.

X Q. 40. Using the word "factor" to cover such things as grade and recovery and operations of the classifying machines, and various other parts of the operative machinery, upon which, or what part of those do you base a judgment as to the successful or unsuccessful operation of the plant that you are testifying to?

A. On the recovery; on the grade of concentrates produced; the successful operation of the plant and of the various machines that constitute that plant and all other factors which come into consideration in the operating of a plant.

X Q. 41. The things which induce recovery in this flotation process are, broadly speaking, oils and acids, aren't they?

A. Yes.

X Q. 42. And you, therefore, as another factor, have to consider the oils and acids used, do you not?

A. I do, and I have.

X Q. 43. Do you personally measure the oil which from time to time is put upon the material?

A. I have.

X Q. 44. (Last question read.)

A. I do, and I have.

2760 X Q. 45. It is your duty every day, is it, to stand at the oiling machine and regulate it so that it puts the proper amount of oil on the material from hour to hour?

A. It is not, but it is my duty to see that the men who are working for me do that, and I check them up.

X Q. 46. In what way do they inform you that they have done what you told them to do?

A. They submit a report each day, of the amount.

X Q. 47. In writing?

A. In writing.

X Q. 48. Are these oiling machines automatic or do they require the manipulation of human beings?

A. They require the manipulation of human beings, as almost everything does.

Mr. Garrison: The latter may be stricken out, because some of them are automatic.

X Q. 49. Next in regard to the quality and character of the concentrates, how is that determined?

A. That is determined by analysis after a sample has been taken.

X Q. 50. And who takes that sample? I don't mean the name of the man, but who, in the course of the business, takes the sample?

A. The sampler.

X Q. 51. Is there more than one of him?

A. There is more than one.

X Q. 52. Is that submitted to you?

A. That is submitted to the sampling department.

X Q. 53. Is that submitted to you?

2761 A. It is submitted to me.

X Q. 54. It comes to you first?

A. It does not come to me first, but it comes as a result.

X Q. 55. Then to whom is it first submitted?

A. It is submitted to me as being one of the——

X Q. 56. (Last question read.)

—. ——.

X Q. 57 (continued). You said it was not submitted to you first; now, to whom is it first submitted?

A. Well, I may have misunderstood the other question; I would like to have that re-read; I may change my other answer.

X Q. 58. Certainly. I have not the slightest wish to confuse you. I want to know this: When the sample is taken by the sampler, what does he do with it; not what somebody else does, but what does he do?

A. He is taking the sample.

X Q. 59. Then what does he do after that?

A. He submits it to the sampling department.

X Q. 60. What do they do?

A. They submit it to the assaying department.

X Q 61. What do they do?

A. They analyze it.

X Q. 62. What do they do with it?

A. They make a report of it.

X Q. 63. To whom?

A. I get the report of that.

X Q. 64. Does that also determine, not only the recovery, but also the grade?

A. It does.

2762 X Q. 65. Who regulates the feed of the material?

A. The operators in charge of the flotation plant.

X Q. 66. Have they any other title than simply operators?

A. Foremen; there are three of them.

X Q. 67. And these foremen do they make reports of the rate, and the amount of feed, etc.?

A. They do.

X Q. 68. What about the quality of the ore; who determines that, the amount of mineral in the ore?

A. That is also determined by the sampling and assay department.

X Q. 69. Are there separate samplers who take that and take it to the assay department?

A. The same samplers take the original ore as take the concentrates and tailings.

X Q. 70. And that all comes back to you in the form of written reports from somebody, does it?

A. It does.

X Q. 71. And from all these original sources you make up these tables that you have been asked about, is that correct?

A. That is correct.

Mr. Kremer: I renew my objection, if your honor please.

The Court: What principle of the local law of evidence will you appeal to, just in general?

Mr. Kremer: Only the general principle that a superintendent or manager of a business who has the personal conduct of the

2763 business and has at his disposal personally that which indicates the conduct of the business from day to day and upon which the business relies in conducting its ordinary affairs, he exercises a general supervision, he can testify to that which is carried on under his direct supervision, even though it is made from a number of different statements from different sources. It is the same principle of law that will permit a bookkeeper in a department store to testify that Mrs. Jones bought a paper of pins, a spool of thread and a yard of silk upon a certain day. They are entries made in the ordinary course of business. It would be a useless thing and an unnecessary thing to say that we had to call the girl who sold the spool of thread and so on—without prolonging the illustration. I am perfectly serious and I don't want to be facetious in the matter.

The Court: The Supreme Court of this state has ruled that the books which you speak of are only memoranda. It would not do for the bookkeeper to come in and say that Mrs. Jones bought a yard of silk. That wouldn't prove it, necessarily.

Mr. Kremer: Your honor is right in that assumption. I must show that these entries were made in the ordinary course of business. The mere fact that the books show a certain thing is not sufficient, and this is the test. The thing that makes this competent is to show that they were kept in the ordinary course of business. That is a pre-requisite. The mere presentation of the books is not sufficient. But, if the books are shown to be kept in the ordinary

course of business there is a presumption that in the keeping of these accounts and books and records of the business, in its course
2764 of conduct, are correct, and relying upon that, in giving the direction to your business, there is a presumption based upon that reason that fallacious conditions would not exist because the whole business would be destroyed. That is the evidentiary principle, and that is a prerequisite, and so that is the ground I have earnestly contended that from the very beginning if it is shown that these records are made up in the ordinary course of business and are the records of a going operating concern, where one has had a superintending capacity over them and can identify them as the result of the ordinary conditions of the operation, that that is sufficient. Now, the reason for that, if your honor please, I think becomes apparent. Take the question which your honor now has under consideration. This is not something that is not available. This is something that—if the rule of law is not as I maintain, that it is and I earnestly contend that it is so, but if it were otherwise, we can prove these things; but the rule of law exists solely for the purpose of obviating the necessity of doing such a useless thing as here one would be called to do, to bring down at least, without any exaggeration, fifty or sixty men for the purpose of saying: Yes, that is so; I did it; it is correct. "Do all the duties that you perform in the course of your employment indicate the correctness of your actions?" "Is this true?" "Did you make a mistake?" "No." "I did not." "They are all correct."—Bring each one of them down and it is basically proven, what the law of evidence I think considers a useless thing, a useless showing. And for that reason
2765 this very same and logical rule is adopted. There is no position that counsel are placed in that would cause them to suffer the slightest embarrassment, because they can attack anyone of these various matters, even to the end of calling the men. I don't think there is any difference in the rule of law of the records of an operation conducted in the ordinary course, under the supervision and superintendence of one who says he knows it to be correct. Now, the test of the credibility of this would resolve itself solely into the impression that the witness created upon the court.

Mr. Garrison: Have you finished?

Mr. Kremer: I have.

Mr. Garrison: As far as Mr. Kremer has gotten in his exposition of the law, he has stopped far short of what he has offered here, and I do not think it is worth while to discuss something that is not before us. He says that if they had regularly kept books which are not themselves the books of original entry, but are made up of other original sources of information, these books are admissible. I do not care to debate that with him, if that was what was offered. We have no such thing offered now. We have a table made up by this witness, something typewritten perhaps day before yesterday—it makes no difference when it was typewritten, or when it was composed. It does not purport to be a book of the company made up in the ordinary course of business part of their daily routine, with whatever effect, legally, that might have as evidence. And I most re-

spectfully submit that no authority in any court of justice
2766 under the common law can be found for giving probative force to a table made up by a witness from not even original sources of information of his own. That is a very doubtful question, if not determined entirely the other way, but certainly not a table made up from original sources of information of which he has no knowledge whatever. That could have no probative force. The very statement that it would take 500 men to justify this table shows the table itself cannot be evidentiary.

The Court: Suppose he has made it from daily reports in writing to him by numbers of subordinates? Can't he make a tabulation from those reports?

Mr. Garrison: After they are in evidence.

The Court: Bringing his records along, say, "Here are the reports; here are my papers."

Mr. Kremer: We will produce all of them—I beg your pardon, I did not intend to interrupt you—if you desire all of these I will produce them; they are all available.

The Court: Just a minute. Let the counsel discuss this with the court for a minute or two.

Mr. Kremer: I beg your honor's pardon.

The Court: I want to know what their position is. Now,——

Mr. Garrison: I have known the rule to be stretched to this extent, for the benefit of the court and solely for the benefit of the court, that where the original sources of information are numerous, such as these reports undoubtedly are, and where the only proof that may be offered, which is these reports has been offered and accepted, the court has then permitted someone like an auditor or a super-
2767 visor or a superintendent or a manager to tabulate and make a statement which is given him as illustrative of his evidence; but it has no probative force whatever, absolutely no probative force. It simply is illustrative, of his evidence, he having gone through the original sources of information for the benefit of the court and furnished the court with a convenient tabulation. Now, I have never known it to go any further than that.

The Court: As supplemental of this report, and you have them to verify.

Mr. Garrison: Precisely so. We have got the cart before the horse, as unfortunately we are so often faced with in this trial.

The Court: Let's proceed a little farther. The court will not attempt to limit you. You say you have these reports, but not here.

Mr. Kremer: Certainly; we haven't them right here. They will be here as fast as a couple of wagons can bring them down.

The Court: My only question is on the attitude of counsel. You must remember we are trying this case according to the established rules of evidence, except as there may be some special rule established by Congress, and I do not know of any local rule or any decision of the Supreme Court that will allow you to introduce books and let a bookkeeper say—or introduce reports and let an auditor say or a bookkeeper "These are furnished to me every day and are repre-

sented to be correct." I don't know of it. I think it is rather the other way in this jurisdiction.

2768 Mr. Kremer: I agree with your honor. Naturally we will proceed to supply the original documents.

The Court: Since you can supply it and since you have insisted on it you better have these things here and then we will meet these objections when the time comes.

Mr. Kremer: We will be very glad to bring up all of the books and reports and they can bring all the men if they want them.

The Court: The court is naturally anxious for anything to expedite things, and to expedite things, but it must see that this case is tried according to settled rules of evidence. They have the right to insist upon it, if that is the law. Now, if you have any authorities with you I would be glad to hear them.

Mr. Kremer: As to my position, I think I can furnish you with a host of authorities.

The Court: We will give you an opportunity to be heard. This objection will be——

Mr. Scott: May I ask the witness how long it will take to get these original reports? They include all the assay sheets I suppose and many other memorandum and reports?

Mr. Dosenbach: Well, I should say it will take a day, all of today.

Mr. Scott: Well, then, we will have to withdraw this witness and continue his examination after we are able to obtain these original records.

Witness temporarily excused.

2769 The Court: I would be glad to see from both sides, if these questions and these objections to this character of proof are to be offered and this variety of objection interposed, I would like to see the local law, the decisions in point, and others also if there are any that we ought to consider and be controlled by here.

Mr. Kremer: A very recent decision and I think your honor probably has it in mind, by our Supreme Court in connection with the record of account, which I think is what your honor had in mind when you said that the book itself would not be evidence—a case decided about 18 months ago—but this was not supplemented by the testimony of the correctness by one who had charge of the records. I think that is the distinction there, otherwise I think that we would quite agree that that was the rule.

The Court: You may look up the question and I will hear you later on both sides. In further reference to the point that has come up. Unless the sources from which he made his compilation would themselves be admissible, of course the compilation would not be admissible and would these reports that he received daily from his subordinates of themselves be admissible without verification by the subordinates who made them? That is one of the principles involved in this question.

Mr. Kremer: I would say this: That if the report was the subject of something that was conducted under the supervision of the man-

ager or superintendent, and were submitted to him in the
2770 ordinary course of business, they became a course of business.
Now, for instance, just use this test, if your honor pleases: Suppose this was an action for accounting. Could there be any question but what these reports would be absolutely conclusive against us, if admitted.

The Court: Of course evidence that might be conclusive against you may be no evidence in your favor.

Mr. Kremer: Only for this reason and that is because they are interpreted to be self-serving declarations. But the purpose for self-serving declarations did not exist at the time of the making of the reports, so that test is removed.

The Court: Well, but this litigation has been pending a long time. Most of these things you are asking about I suppose was previous to the litigation.

Mr. Kremer: But there was a time previous to this litigation when all——

The Court: All right, we will hear the law on that, but I simply want to hear you.

Mr. Scott: We will have Dr. Sadtler take the stand for a part of his testimony.

The Court: Very well.

Dr. SADTLER, called as a witness in behalf of the defendant, being first duly sworn, testified as follows:

Mr. Williams: In regard to this question of the character of proof for admitting further operations at the Butte & Superior mine.
2771 The plaintiff is desirous of facilitating the presentation of the case, but plaintiff is suspicious of reports that are made up for the purpose of this trial. Now, I take it, that in the records of the Butte & Superior Company in the ordinary course of their business, that from time to time a regular tabulation—in the ordinary course of their business they from time to time prepare a regular tabulation of their operations. Possibly this witness has tabulations made covering periods of time. The point that we are insisting upon is that we should have these things that were not prepared for this trial, but were prepared in the ordinary course of business of the company, and if there is any way of presenting it upon such a basis as that we will not insist upon all the original written sheets or anything of that sort. We do not want to stand for the strict measure, but we do want these records and reports which were prepared in the ordinary course of business, to compare.

The Court: There is a way you can get them possibly if you confer together you can arrange the point.

Mr. Kremer: My only purpose in making that—anything you want we will furnish you along that line, but it does seem to me that to do that useless and idle thing, which we will now proceed to do, to load up a couple of trucks and bring them into this room—we will give you whatever you want. If you wish Mr. Dosenbach to proceed, Mr. Dosenbach will testify from his notes and from his

compilation as to the conditions. Then if you have mis-
2772 givings as to certain portions of that testimony you would in turn then demand and say, "Will you furnish us with the copies of those days or those months' operations." Very gladly we would do it; very gladly do it. But otherwise we will comply with the decision and the ruling, of course. Of course we are going to get this testimony in and if that is satisfactory to you we will do it, and if we are not able to furnish it or do not furnish it upon demand we, before the motion is made, consent that that portion of the testimony may be stricken out.

Mr. Williams: I do not know how the Butte & Superior Company keeps its records. You and the witness do.

Mr. Kremer: I suppose the witness does.

Mr. Williams: Suppose for example that the witness were to say that on a certain day the operations were as follows:—he would produce a report of that day which he made at that time and his records, would he?

Mr. Kremer: Yes.

Mr. Williams: And then we could have that put in evidence.

Mr. Kremer: Yes, I think that is correct, isn't it, my statement—I answered "Yes" because that was my idea.

You would testify upon a certain date the operation was so and so, using a more specific illustration, you used a certain amount of oil. That is made from a compilation of the records submitted to you in the operations over which you had supervision.

2773 Mr. Dosenbach: Yes.

Mr. Williams: And you can produce the record for that?

Mr. Dosenbach: I can produce the oil record for that day or any other record of that day.

Mr. Williams: And you have memoranda of this which you made at that time, is that right?

Mr. Dosenbach: Yes.

Mr. Williams: We will waive the strict measure of proof if we may proceed in that manner.

Mr. Kremer: We will be very glad to comply with any such.

The Court: Will this witness testify?

Mr. Kremer: He will be withdrawn and Mr. Dosenbach will proceed in the regular way.

The Court: I understand he hasn't the records with him at this time so that he will have to take the stand and leave it again.

Mr. Kremer: We have the stipulation and Mr. Williams will ask us to furnish him certain records which we will furnish without bringing the whole office down.

The Court: If you think you can negotiate to restrict the record, it will be to the advantage of both, and of course to the court; but the court when an objection is made, will rule on it. Is this witness, Mr. Dosenbach, to testify now, and produce these records later if you call for them?

Mr. Kremer: And you can recall him for cross-examination upon them.

2774 The Court: He hasn't them in court then this moaning.

Mr. Williams:

Q. 72. Mr. Dosenbach, what records have you with you today? Suppose I were to ask you what the operations were on a certain day, what have you to show those operations?

Mr. Dosenbach: I have the daily records for the—of all of 1917 with me today.

Mr. Williams:

Q. 73. And nothing more?

Mr. Dosenbach: And the daily records prior to that time I haven't with me.

Mr. Williams: You better have these with you before you testify.

The Court: Very well, proceed with the witness.

Mr. Scott: In order that there may be no misunderstanding, I would like to ask what these daily records that he refers to are so as to be sure that they will be such as will be acceptable. What are these daily records, Mr. Dosenbach, for 1917, that you refer to; something that you have compiled from original records or are they the original records?

Mr. Dosenbach: They are not the original records; the compilation of each day's original records.

Mr. Scott: Supposing you let me see what they are and we will find out so that when we come to it again we will know. What was the nature of the original records? Is there any single original record containing all of the information for one day? Does it all show there for one day on that tabulation?

2775 Mr. Dosenbach: There is no single record.

Mr. Scott: How many single records for each day would be necessary in order to put before the court the history of that day's operation?

Mr. Dosenbach: Well, I suppose from 6 to 18.

Mr. Scott: And these records, what are they?

Mr. Dosenbach: The oil records.

Mr. Scott: Made by the oil sampler or chemist?

Mr. Dosenbach: Oil foreman. The assay record.

Mr. Scott: Giving the grade of concentrate, headings?

Mr. Dosenbach: Yes, headings and tailings. The tonnage record samples.

Mr. Scott: Made by some one in charge of that?

Mr. Dosenbach: Yes. And the oil analysis record made by the oil chemist.

Mr. Scott: All of these are separate reports, are they?

Mr. Dosenbach: They are.

Mr. Scott: Are there still more of them?

Mr. Dosenbach: Well, then there is the individual shift report.

Mr. Scott: What does that set forth?

Mr. Dosenbach: That sets forth the operations of the flotation plant, the amount of oil used, the amount of acid used, the amount of other reagents used, and other factors that are taken into consid-

eration in directing the operations of the flotation plant.

Mr. Scott: That about covers it?

2776 Mr. Dosenbach: That will cover it pretty well.

Mr. Scott: Now, in connection with any particular operation that is required you want those records that Mr. Dosenbach mentions, these original certificates, do you?

Mr. Williams: We may.

Mr. Scott: Well, do you want them all brought here or do you want to make us a list of your requirements during the examination so that they can be sorted out and brought here in a bunch?

Mr. Williams: We would be willing to call for any particular requirement and give you an opportunity to bring it later.

Mr. Kremer: Why can't we proceed then? We will accept that.

Mr. Williams: As I understand it, there is practically nothing in the way of daily reports prior to 1917 that the witness has with him. Therefore he will be unable to give us any information.

Mr. Scott: In 1917 he has his compilation. He hasn't these original papers that you have been speaking of.

Mr. Williams: And prior to 1917 he hasn't anything except a general tabulated statement which we don't regard as evidentiary until something else is produced.

Mr. Scott: Well, these tabulated statements prior to 1917 are of course the averages of daily operations, for any of which daily operations he can produce the original memoranda that you refer to.

2777 Mr. Williams: I think that when the witness has brought with him a tabular statement of daily operations prepared not for this trial as I understand——

Mr. Scott: There is no such thing, they are not prepared in that form for any other purpose.

Mr. Williams: And for that total statement of daily operations then as I understand it, he has none for 1917. We will endeavor to make such a waiver of strict objection as will bring about the production speedily of the evidence that the defendant desires.

Mr. Scott: Mr. Dosenbach, one more question, please. Will it be possible within the limits of time of this trial to prepare a daily statement for the years prior to 1917 corresponding to the daily statement I think you have for this year?

Mr. Dosenbach: It would take quite a long time. I don't know whether it would be possible to get it out or not.

Mr. Kremer: The limit of the trial would be proof of this.

Mr. Garrison: I think we would make progress if we have a conference during recess and see what we can do about this thing. Is that satisfactory, gentlemen?

Mr. Kremer: Yes.

Mr. Garrison: We will have a conference at recess and endeavor to shorten this thing as much as we can.

2778 SAMUEL P. SADTLER, after being duly sworn as a witness for defendant, testified as follows:

Direct examination.

By Mr. Scott:

Q. 1. Please state your name.

A. Samuel P. Sadtler.

Q. 2. Doctor, please state your occupation and qualifications to testify on subjects of the kind before the court.

A. I have been a professor of chemistry for many years, but am not now active in that line, but for the last thirty years I have been a consulting chemist in connection with many chemical manufacturing operations, and have particularly practiced as a chemical expert in chemical patent litigation during the last thirty years. Do you want my educational qualifications?

Q. 3. I think so, doctor.

A. I was graduated in 1870 as a bachelor of science from Harvard University. In 1871 I made my Doctor of Philosophy degree in the University of Gottingen, Germany. Since 1871, as I said, I have been teaching chemistry, and for thirty years past actively in the practice of applied industrial chemistry. I have made a particular study of industrial chemistry in most of its branches, and I published already in 1891 a Handbook of Industrial Chemistry for manufacturers as well as students, in which the chemistry of petroleum and of oils, both fixed oils and fatty oils was thoroughly
2779 covered, both the chemical nature of these materials, as well as the manufacturing operations and a study of the products. I have also had special experience in connection with the nature of essential and fatty oils, because I have been since 1880 the chemical editor of the United States Dispensatory, which is a standard book covering a wide range of materials of this kind, particularly for reference in the medical and pharmaceutical profession. I have had a special acquaintance with petroleum matters, however, because, from 1875 on I have been collecting and classifying petroleum and petroleum products, first for the Geological Survey of Pennsylvania, and afterwards for the various parties who desired investigations of these materials, and in that connection I have visited the petroleum fields throughout the country. I have also had, in connection with my patent litigation work, the study of a great many products, both in oils of petroleum and fatty and essential oils.

Q. 4. Have you made any investigation of the processes referred to in United States Patent 835,120, the patent here in suit?

A. I have personally carried out experiments in that line, and have witnessed a great many other experiments, beginning with the summer of 1914.

Q. 5. I notice that in the opening part of this patent reference is made to certain Cattermole patents, Nos. 777,273 and 777,274, and the text of the patent purports to draw a certain distinction between those Cattermole patents and the process of Patent 835,120.

2780 Can you state whether your investigations have confirmed the distinction there set forth or not?

A. That question is so comprehensive that I would have to analyze it in some detail.

Q. 6. You may take your time, doctor.

A. I would like, before attempting to make any attempt at sharp distinctions—I would like to classify in a general way the processes which involve the use of oil in oil concentration. The first use of oil in this connection of oil concentration would be for the purpose of agglomerating the sulphide and other mineral particles into masses from which the gangue can be separated by various washing out processes. Now, in this category will fall, of course, the Cattermole process of making granules and washing them out by up-cast. In this category would also fall the Haynes invention described in the Haynes patent, and the first process of Everson would also involve the agglomeration or bringing together of the sulphide particles with oil and the washing out process.

The second category is that of producing conditions which will permit a flotation of sulphide particles by attachment to gaseous bubbles in which case the amount of the oil and the character of the oil are varied quite considerably, and will vary, according to practical experience, with the individual ores to be treated. Under this category will fall the patent in suit, No. 835,120, and a number of patents of the prior art, viz., Everson Second Process, for example;

2781 Froment; the foam effect method of the California Journal of Technology; and Kirby.

The third category includes those processes in which the particles are caused to float as a film on the water's surface, mainly by reason of the surface tension. A number of patents have been taken out in that line; MacQuisten, and some of the patents of Sulman & Picard.

The fourth and last category is where the sulphide particles are to be floated by the actual buoyancy of the oil, under which category we have the Elmore process, which was also discussed by the writers of the California Journal of Technology, articles, under the name of the "Lake Effect."

I have thus, in a general way attempted to classify the various processes, and with this classification in mind I am ready to take up Patent No. 835,120 and discuss it, and incidentally in that connection the differences from Cattermole will be indicated.

In Patent 835,120 we have first of all a statement of invention. Now, the statement of invention is one of the earliest parts of a patent, and that is found on page 1 of the patent, lines 9 to 15, and again, lines 28 to 35, we have the following:

"This invention relates to improvements in the concentration of ores, the object being to separate the metalliferous matter, graphite and the like, from gangue by means of oils, fatty acids, or other substances which have a preferential affinity for metalliferous matter over gangue." And again in line 28: "We have found that

2782 if the proportion of the oily substance be considerably reduced, say to a fraction of one per cent of the ore, granulation

ceases to take place, and after vigorous agitation there is a tendency for a part of the oil-coated metalliferous matter to rise to the surface of the pulp in the form of a froth or scum."

That last portion, beginning "there is a tendency," is therefore the result of the invention. That is the result of the invention. "A tendency for part of the oil-coated metalliferous particles to rise to the surface and form a froth or scum."

Now we have, following that, a statement as to how this tendency is aided. In lines 35, and following on for some distance, I read:

"This tendency is dependent on a number of factors," and the factors mentioned here are three in number. "Thus the water in which the oiling is effected is preferably slightly acidified by adding, say, a fraction of one per cent of sulphuric acid or other mineral acid or acid salts, the effect of this acidity being to prevent gangue from being coated with oily substance, or, in other words, to render the selective action of the oil more marked; but it is to be understood that the object of using acid in the pulp according to this invention is not to bring about the generation of gas for the purpose of flotation thereby, and the proportion of acid used is insufficient to cause chemical action on the metalliferous minerals present."

That is the first factor which is to be considered in understanding this tendency, referred to before.

2783 The second factor is: "Again, we have discovered that the tendency for the oily substance to disseminate through the pulp and the rapidity with which the metalliferous matter becomes coated is increased if the pulp be warmed." That is the second factor.

Again: "The formation of froth is assisted by the fine pulverization of the ore, and we find that slime mineral most readily generates scum and rises to the surface, while larger particles have less tendency to be included in the froth." That is the third factor.

Those are the three factors which are mentioned.

Now, turning for a moment to lines 89 to 96 inclusive, we have a statement of the observation of the patentees: "When agitation is stopped, a large proportion of the mineral present rises to the surface in the form of a froth or scum." That is the observation. Now, we have following that a statement from that observation, an expression of a theory:

"Which has derived its power of flotation mainly from the inclusion of air bubbles introduced into the mass by agitation, such bubbles or air films adhering only to the mineral particles which are coated with oleic acid."

This is the only statement of the theory of air bubble flotation as produced by vigorous agitation, which is contained in the patent.

When operating the second alternative process which is referred to on page 2 of the patent, this theory does not apply. On page 2 of the patent, line 103, we have an alternative method given.

2784 This alternative method involves the recovery of the sunk oiled metalliferous matter which may be deposited in the second or third spitzkasten, and, is as follows:

"The products suspended in circuit liquor are removed from the

spitzkasten and placed in a vessel in which they are submitted to an additional pressure of air or other gas of from, say, one to two atmospheres or over. On relief of such pressure the bubbles of air or other gas so generated throughout the mass at once sweep to the surface thereof all the metalliferous matter in the form of a froth which can be separated as before."

It is not dependent upon the entraining of the air by vigorous agitation, but is a secondary process for the recovery of additional metalliferous matter by the generation of bubbles following the introduction of air or gas under pressure in the liquid, which bubbles rise and carry, attached to them, a certain additional amount of mineral particles. None of the claims of the patent give us any theory of oil flotation, neither the theory mentioned on page 1 nor the method referred to on page 2. These claims, therefore, tell us nothing in regard to the air bubble production or the function which was ascribed to it in those lines on page 1. The claims are referred to a froth production as a result of agitation, and in those claims, which have been declared valid by the United States Supreme Court in the Hyde process, this froth production is specified to be in the presence of an amount of oil less than one per cent.

Now, going back to the theory of lines 92 to 96 on page 1—
2785 it is not new to this patent. It is found stated quite clearly in Patent No. 793,808, page 1, lines 65 to 79, a prior patent issued to Sulman & Picard in July, 1905. I find it there stated:

"The oiled metalliferous particles resulting from either of the processes above described have the power of attaching to themselves with a greater comparative strength than the gangue particles, the films or bubbles and gas, which exist in the mass, and are thus raised to the surface of the liquor by gaseous flotation. They can then be removed by skimming or other suitable means. The gangue particles unwetted by oil or grease are not floated up with the oiled mineral particles, and thus in the main remain at the bottom of the vessel containing the mixture."

By the above matter this function of the gas bubbles is clearly stated. Also in Froment, the Italian patent dated 1902. In the third paragraph of this patent we find the following:

"If a gas of any kind is generated in this mass, the bubbles of this gas become covered with an envelope of sulphides, and thus rise readily to the surface of the liquid, where they form a kind of metallic magma."

I think all the essential features of the theory stated, therefore, on page 1 of Patent No. 835,120, can be found in these two prior references which I have mentioned.

Various statements have been made by the witnesses and by counsel in different stages of the Hyde case to the effect that the
2786 patentees discovered a new agent in the air bubbles which, in combination with oil in unheard of minute proportions, and in such proportions performing a new function, accomplish a new and revolutionary result; that under an intense agitation in the presence of a mere trace of oil, such that the metallic particles are coated with a thin, attenuated coat of oil, so thin as to be imperceptible to

sight or touch, and so attenuated as to exhibit none of the known properties of oil—air bubbles would be produced and controlled and made persistent; that would firmly attach themselves to the metallic particles, and by their buoyancy float the heavy metallic particles upward to and through the surface of the pulp and form above, and resting upon the surface of the pulp, a floating layer usually several inches in thickness, of a mineralized froth, *constituted* of such air bubbles carrying the metallic particles. It was so stated at the time that these expressions were used in relation to the invention of the patent, 835,120. I do not find this at all in lines 28 to 36, in which the patentees state their invention. They claim only a tendency for a part of the air coated metalliferous matter to rise to the surface of the pulp in the form of a froth or scum, and as before noted, this tendency, the patent says, is dependent upon a number of factors.

I will now take up these factors in detail and examine as to what rights these patentees have in the claiming of the use of these factors as original. The first mentioned factor was the presence of a small amount of acid. That, however, belongs to the prior art.

2787 Dr. Liebmann, one of the former experts in the Hyde case, (Hyde original record page 495) says: "Carrie Everson discovered that preferential ability was rendered more effective and more pronounced if acid was present in the oiled pulp." Later ones of the prior art also use it and comment upon it. We find those references in Cattermole, and California Journal of Technology, and in Kirby.

The second factor is stated to be the use of heat. This also is not original. We find this also referred to already in the Fryer Hill publication on the working of the Everson patent. Dr. Liebmann says (Hyde original record page 544): "The Fryer Hill Publication of 1889 is clearly a further development of the Everson patent. It adds to Everson the use of heat." Kirby also refers to the use of heat if desirable.

The third factor which is referred to in patent 835,120 is fine pulverization. While this was not emphasized by most of the prior workers, indications to show that it was not a new feature are seen. The Italian patent of Froment refers to natural sulphides reduced to fine powder as the subject matter of his experiment. In the English patent of Froment, the patent solicitor, Lake, dropped the word "fine." In Kirby patent we have similar indication that fine pulverization was practiced. On page 3, lines 51 to 55, we have the words: "The water, even near the top, is not clear, but turbid or muddy, with slimes or fine particles of non-coated minerals, which had not settled rapidly enough to get out of the way." The

2788 practice and value of fine pulverization is also mentioned in the earliest of the Cattermole patents, which was of course familiar to the patentees of No. 835,120.

Q. 7. What was the number of that earlier patent?

A. I will give it to you. The Cattermole patent 763,259, line 90 on page 1 indicates this as follows: "The finer the ore the more compact and cohesive are the granules formed from it, other things

being equal." I turn now to the nature of the product disclosed in patent 835,120. The product of the invention is stated in line 35 of page 1 to be a froth or scum." In giving their theory as to the froth production in lines 91 to 96 of page 1 the patentees say: "A froth or scum which has derived its power of flotation mainly from the inclusion of air bubbles introduced into the mass by agitation, such bubbles or air films adhering only to the fine particles which are coated with oleic acid." The claims of patent 835,120 all refer to the froth with no mention of its structure or component parts The question now to be discussed is: Was this gaseous froth produced by agitation a new discovery? An examination of the prior art will show that it was not. It was produced in the practice of the second method of the Everson patent. The Everson patent, page 2, lines 99 to 105, says: "In practice, the concentrate, after thorough agitation of the mass and detachment of the sand, will in this case be preferably removed by means of a constant overflow of water from a washing-out vessel, by which overflow the concentrate will be floated off." We have here, as first stated, the thorough
2789 agitation of the oil, principally to entrain air; second the detachment or settling of the sand; and third, the floating off of the concentrate as an aerated froth. In the Fryer-Hill publication of 1889 describing the carrying out of the Everson process we are told that the action of the revolving tube, the fans and injected acidulated steam causes the lighter portions of the mineral-charged oil to float. This was clearly a mineral-laden aerated froth. I have no paging or number of lines to indicate the exact position of that in the Fryer-Hill publication, but it can easily be found. In the Criley and Everson publication, still referring to the carrying out of the Everson process, we are told that as a result of the operation a thick scum of sulphurets rose to the surface and was skimmed off. As the patent in suit uses the words "froth" and "scum" as synonymous, there is no reason to doubt that this was aerated froth or thick scum of sulphurets full of air bubbles which as described left the hitherto black ore as white as snow, in fact pure silica. We have next the Froment Italian and British patents. We are told by counsel for the Minerals Separation that following the issuing of the British patent, August 8th, 1903, Mr. Sulman saw a publication describing it, and learned thereby that Froment was an earlier inventor of the broad idea of floating oil-moistened metallic particles by air or other gases which had been invented by himself and Mr. Picard. This states the facts. The British patent of Froment says:
"If a gas of any kind is liberated in this mass the bubbles of
2790 the gas become covered with an envelope of sulphides and thus rise readily to the surface of the liquid, where they form a kind of metallic magma." It will be noted that it is the bubbles of the gas which rising form the magma. This magma of gas bubbles coated with oil, and covered with an envelope of sulphides is undoubtedly an aerated metal coated froth, which has often been described by plaintiff's counsel as a heavily, armor-coated froth, capable of having considerable superimposed weight upon it. But we are not obliged to trust to our own views on that subject. We

have the testimony of Minerals Separation themselves as expressed in the language of patents applied for and issued to them at a considerably later date than the date of patent 835,120. The views held by Minerals Separation Limited as late as 1910 as to the character of the Froment process and as to its being a true gas bubble flotation are clearly shown in the language of two patents taken out by them in that year. First, British patent No. 10,929 of 1910, to Theodore Jesse Hoover and Minerals Separation Limited. In the complete specifications, page 2, line 47, continuing to page 3, line 4, we find the following: "The object of this invention is to provide simple and effective means for the introduction of air or other gas in a state of extremely fine division into an ore pulp in such a way as to effect the gaseous flotation of certain particles. For example, the patent No. 12,778 of 1902 describes a process of ore concentration which consists in mixing the finely powdered ore with water, adding a suitable oil and then liberating a gas in the mixture so as
2791 to carry the oiled particles to the surface in the form of a froth, and the present invention is particularly applicable to a process of this general type." This patent No. 12,778 of 1902, is the British Froment patent. Again, in this same patent, No. 10,929 in 1910, on page 3, lines 30 to 34, the character of the Froment process is still more expressly stated in the following language: "A number of ways are known for treating an ore pulp to facilitate or to render possible the selective flotation of certain constituent particles in the form of a gaseous froth, see for example the processes described in patents Nos. 12,778, 1902, 7,803, 1905, 28,173 1908, and 2,359-1909. The present invention may be used in conjunction with any such process." It will be noted here that the Froment British patent is bracketed immediately with British patent 7,803 of 1905, the patent corresponding to that patent 835,120 as easily productive of a gaseous froth as its result. British patent No. 23,870 of 1910 to Minerals Separation Limited and Edward H. Nutter, in the complete specifications, page 5, lines 22 to 24, after referring to their invention as a floation process obtaining froth or scums containing metallic components, says: "The processes employed to obtain these froths or scums may be any of the well known flotation processes as described for example in patents Nos. 12,778-02, 29,374-04, 7,803-05, 26,852-08, 28,173-08, 2,359-09, etc." We note here again the bracketing of patent No. 12,778 of 1902 and 7,803 of 1905 as equally valid and available. These two patents, thus
2792 bracketed, were the Froment British patents and British patent corresponding to 835,120. They are declared as equally valid and available for raising froths and scums containing mineral oil. We also note the reference in this patent 23,870 of 1910, to both the patents 12,778 of 1902 and 7,803 of 1905 as well known flotation processes.

We have next, in the prior art, the publication known as the California Journal of Technology issued in November, 1903.

Mr. Williams: If your honor please, that not being in evidence, and therefore your honor not having a copy of it, while I do not

wish to interrupt the witness, I think defendant's counsel should at least supply your honor with a copy of it. Of course it was gone over thoroughly in the Miami case and your honor has perhaps seen it.

Mr. Scott: We can furnish the copy.

Mr. Williams: I suggest that you furnish a copy to the court.

Mr. Scott: The original is on page 34 and continuing.

Mr. Williams: Now, for instance, there is another patent the witness has just referred to, Hoover British patent, 1910—something, and your honor has never seen that. It is not in evidence, and if you will just hand that up when the witness refers to them, I think it would help the court.

The Court: You may proceed.

A. Well, next, the publication known as the California Journal of Technology issued in November, 1903.

2793 Mr. Kremer: At this time we offer in evidence the California Journal of Technology, the articles found on pages 34 to 41, the number of November, 1903.

Mr. Williams: The only objection that is made to this publication is on the ground of estoppel; this new defense can not be interposed. Although the document is not proved to be a publication, we are satisfied from investigations that we have made that it is, so we do not object to it on that ground.

Objection overruled. Plaintiff excepted.

California Journal of Technology of November, 1903, marked Defendant's Exhibit No. 47 and admitted in evidence.

Whereupon an adjournment was had until 2:00 p. m.

2:00 o'clock p. m.

My Mr. Scott:

Q. 8. Doctor, do you remember where you left off before the adjournment for lunch?

A. I had mentioned the California Journal of Technology, and given the date of it.

The authors of that publication referred to what they use in their test as consisting of a thin ore pulp and oil, and as being agitated, so apparently——

Q. 9. What page are you reading from?

A. Page 36 of the original pamphlet.

Q. 10. Doctor, if I might make a suggestion, wouldn't it be well to make it clearer, to state what these investigations start out with?

2794 A. Well, yes, I might do that. The authors of this article in the California Journal of Technology head their publication, "Experiment on the Elmore Process of Oil Concentration." And a large portion of the article is devoted to and refers to the Elmore processes, which they have designated as the "Lake effect" in their article, but already in their article on page 36 of the publication

they show that they are making experiments on entirely different lines.

Q. 11. Before you go on, state briefly what that Elmore oil process is, and whether it falls in one of the classes that you divided the art into this morning.

A. The Elmore bulk oil process which they are principally discussing and referring to repeatedly under the name of the "Lake effect," is one of those processes which I refer to as an illustration of group four, or class four of the first classification that I made, in which the mineral particles are floated excessively by reason of the light specific gravity of oil layers into which they are taken, and in which they are carried or suspended. It does not depend upon aeration for the production of air bubbles. On the contrary the production of air bubbles is undesirable and is constantly referred to as to be avoided in the carrying out of the Elmore bulk oil process.

Q. 12. Have you any knowledge as to the amount and kind of oil necessary in the Elmore bulk oil process?

A. By reason of the conditions of flotation there, namely, that the mineral particles are to be carried entirely by reason of the
2795 lighter specific gravity of the oil, we are dependent there upon the difference in the specific gravity between the oil layer and water, which is a very small difference with the majority of oils, which have an approximate specific gravity of close to .9, as against 1, which is the specific gravity of water. Now, that same buoyancy of the oil is all there is to cause the raising and flotation of the mineral, and therefore it takes a very large bulk of oil to lift the mineral, and the amount has been repeatedly stated as from 100% to 300%, reckoned on the weight of the ore.

Q. 13. That would be about three times the weight of the ore in oil?

A. From one to three times as much as the ore itself weighed.

Q. 14. That would be one to three times the weight of the ore in oil?

A. One to three times as much as the ore weighed.

Q. 15. And as to the kind of oil, as to its viscosity or any information on that line, in the Elmore process?

A. Yes, it has been repeatedly stated that the oil must be a thick, viscous oil, and a petroleum oil is frequently used for that reason. Then we have there a thick and viscous oil, and one which is not readily floured, as it is termed, or broken up by any incidental agitation.

Q. 16. Have you made any experiments on a small scale with the bulk oil process that serves to confirm these views you have expressed as to the character of the process?

A. I carried out the process by rotating a bottle containing
2796 the oil and the floating particles and following exactly the general direction. I carried out the experiment in a bottle and by a number of rotations of the bottle so that the floating particles containing the oil were passed through the oil layer. The oil was caused to take up a considerable quantity of the mineral

particles which adhered in suspension, as it might be termed, in the oil layer.

Q. 17. Did you carry out any experiment using the Elmore procedure, but with a smaller amount of oil or an oil that was not viscous?

A. Yes, experiments have been carried out in that way also.

Q. 18. And what was the result of reducing the quantity of oil or in using a non-viscous oil?

A. In a case where kerosene was taken and an oil which was notably less viscous than the other and particularly where the amount was considerably less than this 100 per cent. referred to, a froth was formed.

Q. 19. And what about agitation in this Elmore bulk oil process referred to in that original as the Lake effect? The character of the agitation?

A. The authors, on this page, on page 36 of pamphlet, take up that matter.

Q. 20. Have you any information independent of this article regarding this matter of the degree of agitation that is necessary for or injurious to the Elmore Lake effect?

A. Oh, in regard to the Elmore. A very moderate amount of agitation is sufficient to destroy the benefit of the Elmore process because in the first place the oil layer is more or less broken or
2797 floured as it is called, and that of itself prevents it exercising its floating power, and in the next place the tendency to overcharge as it is termed, soon becomes evident with a very moderate amount of agitation and the mineral drops out so that the Elmore process is distinctly dependent upon the avoidance of agitation, and slow agitation is a particular feature of it. And as I say also the character of the oil is a very important element in this Elmore process and the amount of oil is of course important.

Q. 21. You consider these the three essential characteristics, the large amount of oil, the viscous oil and the avoidance of violent agitation?

A. Yes, sir.

Q. 22. Now, doctor, following the text of this article somewhat, will you explain to us the nature of the investigation of the authors?

A. As I said before it begins with a reference to the Elmore process of oil concentration, and that is explained and a particular plant is referred to and the process of the operation of this plant is also described, including the centrifugal separator which they say was the latest device which caused this process to be more available commercially than it otherwise had been. And they then proceed to the laboratory method. Now, you do not meet anything in that earlier section which bears on the question of froth formation. It is only a discussion of the Elmore process and the various conditions under which it is carried out. But under the head "laboratory methods," which is really on page 35 of the pamphlet——

2798 Q. 23. What page?

A. On page 35 of the pamphlet we have the following: "In making a test the ore is crushed to a considerable fineness and the

proper charge is thoroughly wetted in the solution to be used, usually water, thus forming a thin pulp." So we have the first piece of information——

Q. 24. Before we proceed to that, doctor, I would like to have you explain that a little more in detail, this apparatus for the Elmore process and that method of separating the oil; so that we have it before us.

A. You mean in the earlier part?

Q. 25. Yes, at the very beginning, and that shows a view of the apparatus and on the next page that shows an illustration of the centrifugal separator of the oil which I think you can make clear to us with a few quotations from the text. Well, if in your description, doctor, you will not refer to those numbers because they do not appear on the original and they were put on by a witness, and so do not rely upon identifying anything by those extra letters that were put on there.

A. Well, we have in the first place a reservoir in which the thin ore pulp and the oil are introduced.

Q. 26. That is in the upper left-hand corner of the picture on page three——

A. Yes, then we have a cylinder in which a commingling under careful conditions of this ore pulp and oil is to be effected, the commingling being effected there by this slowly rotating screw which causes the *oil* pulp to be brought into contact with the thick
2799 viscous oil, and yet without too much breaking up of this oil. And then from this it is——

Q. 27. Where is the thick, viscous oil, doctor; where is the oil in that apparatus?

A. The oil goes in from above.

Q. 28. In that vessel showing the screw thread arrangement?

A. Yes, as I understand.

Q. 29. And forms a floating mass?

A. The pulp from the mill is indicated there as flowing in through this tube to the side; thence from that rotating vessel, the mixture comes to rest for the purpose of stratifying and gaining layers. Now, in the upper layer, in the thick viscous oil carrying in it, by reason of its buoyancy and floating power, the mineral, and below that of course is the water and the gangue which is not floated, and any other mineral particles which have not yet been taken up into the oil.

Q. 30. The description of what you have just referred to appears in the second paragraph on page 35.

A. Yes, I am looking for that. The second step of the process is to have again the tailings drawn off at the bottom of the separator, with more oil, for repetition of the treatment, and by means of that there was a separation of the steps, so that the tailings from the first contact of the oil and the flowing pulp are worked again, slowly, with an additional quantity of oil. Now, from the last separator, after the tailings have been worked several times, the tailings are dumped. The mineral-laden oil from this last separator, or from those
2800 separators, is collected together in tank B; that is therefore a collecting vessel in which the mineral-laden oil is gathered,

and from that it goes to the centrifugal—however, first at that step it is heated and thinned, to overcome the viscosity, because although that was desirable in the early stages it is not desirable at this stage, and the thinning out of the oil by the aid of heat is desirable. Therefore it is thinned out by heating it, and overcoming the viscosity, and the oil is charged into the centrifugal machines, where the concentrates are separated out by the rapid motion of the centrifugal apparatus.

Q. 31. That is the centrifugal separator illustrated on page 35, is it not?

A. Yes, sir.

Q. 32. You might just refer to that and explain this separation.

A. Well, they dump that material into a basket of perforated metal, which basket is rotated with rapidity, and in that way the heavier material is thrown to the periphery.

Q. 33. That would be what, the heavier material?

A. That would be the concentrate. That is the feature which these young men discuss at some length in the beginning of the article and which they illustrate also somewhat by the illustrations on the following page, figures 1, 2 and 3, as illustrating the centrifugal action. The theory of the separator is illustrated in these figures, 1, 2 and 3.

Q. 34. Now, I wish, doctor, you would explain what these
2801 writers say under the heading you referred to before, "Laboratory Methods." First quoting the passages you are going to comment on as you go along.

A. We come now to what may be called the original work of the authors of this pamphlet. The prior part of the publication is really comment upon what they had found as stated by others. This pulp used, as I stated a moment ago, is formed of ore and water.

"The oil is next added and the whole charge thoroughly mixed. The mixing or agitation can be done in two different ways; the charge may be agitated very gently, the oil being kept in a single lake and broken up as little as possible consistent with thorough contact of the pulp and the oil." That is obviously following Elmore, and the so-called lake which they obtain is a continuous unbroken layer of oil, which is broken up as little as possible, as stated—as little as possible consistent with bringing the oil in contact, and they note that that operation was performed by that screw working through the cylinder; in this case it is done by gently agitating it in some vessel; the vessel is shown below here; now, the alternative method is given, where the charge may be agitated so violently as to dash the oil up into foam and froth full of ore particles. Thus a very thorough contact of the oil and pulp is obtained. Each method has its advantages and disadvantages and these I will discuss later.

The next section is merely a discussion as to the advantages of using galvanized iron or aluminum or glass, and does not have any particular bearing on the difference in the methods which they employed.

2802 Q. 35. Beginning down below the illustration on page 36, they seem to take up the discussion again, the three methods of mixing.

A. Yes; three methods of mixing are referred to.

"Three methods of mixing may be used. One. By inverting the tube several times, thus allowing the ore to fall through the oil. Two. By rotating the tube in a horizontal position, thus throwing the pulp up onto the surface of the lake of oil. Three. By violently shaking the tube, thus producing the foam effect, or at least shattering the oil into small globules. The second method named there is practically another way of practicing the Elmore procedure.

Q. 36. What is this tube that they refer to—something like what is shown in the illustration of Figure 5?

A. Yes, I will refer to that when I get through with the other one. The third method is "by violently shaking the tube, thus producing the foam effect or at least shattering the oil into small globules." All three of these three methods of mixing may be carried on in the same tube, which is illustrated there in Figure 5, and that is a nearly cylindrical tube, narrowing at the bottom, and then having an opening. It is very much what is known in pharmaceutical manufacturing as an adaptor, or a percolator; it is really a percolator, by which in pharmacy extractions are frequently made. At all events the lower end of that tube is closed by a cork, and the top of course may be closed by a suitable cap, and that makes it possible therefore to shake up the contents of the tube very thoroughly. The
2803 stratification that is shown there will be referred to also later.

Q. 37. They have something to say at the bottom of the page about the solution used in the concentration.

A. Yes; as I mentioned before in an earlier part of my testimony, we have here an indication that they recognize the advantage in using an acid solution.

Q. 38. In what passage does that occur?

A. "The solution used in concentration is a matter of some importance. Water is of course used whenever possible, but certain other solutions have important advantages; as before stated, an acid solution is found advantageous." Apparently they did not know at all of the Everson patent of 1885, in which that was already indicated.

Q. 39. Don't they refer to the Everson patent in the first page of that article?

A. Well, they do; I was wrong about that; they do give credit for that feature in the beginning of the article; they recognize that, and state their reasons. "It cleans the metallic surfaces by dissolving the metallic oxide coatings that may have formed on them. It increases the specific gravity of the solution, and it aids in producing the foam effect, which is due to the generation of certain gases." We have here a condition which is indicated of the increasing of the specific gravity of the solution. That is obviously, as will be seen a little later, a matter which bears on the floating power—the buoyant effect of the oil layer as against the watery solution of in-
2804 creased specific gravity, in producing the lake effect. On the

other hand, it states that it aids in producing the foam effect. That is a use of the acid solution for the direct purpose of getting the froth. They explain that as due to the generation of certain gases. Of course that may be so in fact or it may not, but it is immaterial. The advantage of the acid has been shown, irrespective of the fact of its attacking any metallic material by producing gases, simply in illustrating the selectivity.

The next section deals with the specific gravity of the average oil and shows that either acid or salt will raise that specific gravity of water and of course notably a strong salt solution will raise that specific gravity.

Q. 40. The specific gravity of the water?

A. Of the water in which it is dissolved. They obtain therefore a saturated solution of salt at 20 degrees centigrade, containing about 27% of salt, thereby obtaining a specific gravity of 1.204. The reason why they are trying to do this is obvious in the next sentence.

"This gives us a difference of .3 between the specific gravities of the oil and of the solution, and a carrying capacity of the oil threefold greater than with water alone." That has a very important bearing, of course, on the Elmore effect. But we find more than that indicated: "Not only does it give a greater buoyancy to the oil, but it also aids materially in producing the foam effect, and probably aids in brightening the metallic surfaces." So that we have both the action of the acid and the action of the strong salt solution
2805 indicated, and which in their opinion is desirable for either the production of the lake effect or the production of the foam effect.

The next section on overloading, I think bears entirely on the question of the practice of the lake effect. The question is whether the oil is said to be overloaded, and sinks.

We follow next to the bottom of page 37, with a series of figures giving the results of the experiments with some molybdenite ore. There are six experiments here, which represent one or the other of the two forms of treatment that they carry out. The other three experiments, Nos. 7, 8 and 9, are retreatment experiments; but in the six experiments first enumerated it is perfectly clear that, knowing the amount of ore, the weight of the ore treated and the total amount of the oil, those figures being shown in the second and fourth columns—noting those figures we can see at a glance that three of the experiments practically represent the practice of the Elmore method and the other three represent the practice of a method which cannot by any possibility be called the Elmore method, and was designed by them to produce what they call their foam effect, that is, an aerated froth result.

Q. 41. You might refer, doctor, to those relative quantities of ore and oil in the first two experiments, and in Nos. 4, 5 and 6, and tell us what percentages of oil are there stated.

A. The first experiment takes two kilos or two thousand gramms of ore, and 2,400 gramms of oil.

2806 Q. 42. I think if you will refer to the next page you will see that refers to gramms.

A. Yes, it is in grammes. If that is in grammes I will state that again; we get the comparison, then, between the two weights, 2,000 grammes of ore and 2,400 grammes of oil; that is more than 100%. The second experiment takes 2,000 grammes of ore, which is 2 kilos, and 2,000 grammes of oil, exactly 100% *per cent* of oil. The third experiment takes 1 kilo of ore, a thousand grammes, and 1,200 grammes of oil, the same proportions exactly as in experiment No. 1.

Q. 43. Kg. stands for kilogram?

A. Yes, but kilo is the usual abbreviation.

Q. 44. In Nos. 4, 5 and 6 experiments what would be the percentage of oil relative to the ore by weight?

A. There we have to start with, 100 grammes of ore—those experiments start, of course, with a very much smaller amount of ore, working on a smaller scale than in experiments previously mentioned, but the proportions are the important matter. 100 grammes of ore and 2.1 grammes of oil. That is an amount which is 2.1%, reckoned on the weight of the ore. In experiment No. 5, 100 grammes of ore and 5.3 grammes of oil, or 5.3% of oil. In experiment No. 6, 100 grammes of ore and 8.9 grammes of oil, or 8.9%, reckoned by the weight of the ore.

Q. 45. Now, doctor, if you will follow the text of the following page and explain to us the comments which the authors make on these experiments.

A. "Experiments No. 4, No. 5 and No. 6 show the results
2807 obtained by treating separate samples with small quantities of oil, in a salt solution and agitating violently to produce the foam effect. This method gives the highest grade concentrate of any of the direct treatments here outlined. In experiment No. 6 only about 10 cc. of oil was used for 100 grammes of ore, making this 8.9 grammes was used for 100 grammes of ore. You have got an extraction of 75% with the concentrates running 32.4% of molybdenum sulphide. He says that in the extraction that he used about 10 cubic centimeters of oil.

Q. 46. I notice that on the former page he said 8.9.

A. The specific gravity of that oil, multiplied by 10, would give us the 8.9.

Q. 47. Now what follows that?

A. Well, these concentrates are retreated, and he gives them the results of retreatment, "Samples of concentrate running about 26% molybdenum sulphide were agitated in sulphuric acid solution fifteen minutes."

Q. 48. Is this retreatment or reagitation of the concentrates in accordance with anything you know in the present practice?

A. It is current practice, as I understand, almost universally, and reconcentrating.

He goes on to state this agitation caused considerable occluded gangue to free itself. That of course is the desirable thing and is the object for which all reconcentration is practiced. A small quantity of oil was then added and the material reconcentrated, but
2808 there is the froth effect—that means the small quantity of oil, and vigorous agitation. In No. 9 a concentrate running

as high as 50.02 molybdenum sulphide was obtained and the remark is then made that the concentrate such as this would probably be merchantable.

Q. 49. Can you point out a passage in this article where the authors described in particular the characteristics of this foam or froth effect?

A. That is found in a summary which is the last portion of the article, in a summary, a resume, the following suggestion and inferences are obtained. The first "As regards the wetted pulp" and is a matter of theorizing; so is the second paragraph and the third, but we have a separate paragraph headed specially "foam effect," in which their views as to the results they obtained by violent agitation are stated. "The foam effect is produced by a violent agitation, especially in acid or salt solutions."

Q. 50. On page 41 you are reading, is it, doctor?

A. That is page 41 of the article and the very last of the whole page. "This throws the oil into a froth, which is heavily charged with air or other gases. This gas of course gives a greatly increased buoyant force. The oil in this condition assumes a certain load of mineral and holds it in a very stable condition. The charge does not settle and overload on standing as in the case of the Lake effect." Here is a very significant contrast between the results of the foam effect and the results of the Lake effect, expressed in several results.

2809 With regard to the stability with which mineral is held in the foam—in other words, a stable froth holding mineral without dropping it for considerable periods of time; and the statement, too, that the charge does not settle and overload as is the case of the Lake effect or the Elmore bulk oil result, where overloading is one of the matters which they are constantly advising against, or constantly cautioning rather, against. It seems to be this summary and statement there about the foam effect shows very clearly that they understood the various essential matters of the difference, and that they correctly describe an aerated froth; under this name of foam, an aerated mineral laden froth.

Q. 51. Do these other topics on page 38 giving "copper ores" and "copperopolis ore"; 39 "gold ores"; Tuolumne ore; forty "Folsom ore" or do these passages have any reference to the froth or foam effect?

A. They do not appear to have reference to that. We have under that heading "copper ore" the gentle agitation referred to."

Q. 52. Now, I would like to ask you, doctor, whether with the quantities of oil stated in experiments four to nine inclusive, page 37, what the effect would be if one attempted to produce the Elmore bulk of oil or Lake effect?

A. You could hardly get any appreciable result by practicing the slow, gentle movement of the Elmore method with this insignificant quantity of oil.

Q. 53. In what respect do you find this investigation contrasted there from the ore froth effect like the Lake effect?

2810 A. They say here that this method, referring to the violent agitation method, gives the highest grade of concentrate of

any of the treatments given therein and that is illustrated in the tabulation.

Q. 54. You refer more particularly to the procedure and the substance used?

A. I don't quite grasp the point of your question.

Q. 55. I will restate the question. In what respect did these investigators describe their process as different from the Lake effect or the Elmore bulk ore process?

A. They refer to it as being a process, which, while ready of execution and using this relatively trifling amount of oil, is capable of giving superior results and of bringing about by retreatment, marketable concentrate.

Q. 56. In the matter of agitation, how do they describe their process as compared with the Lake effect or the Elmore process; the same agitation or a different kind of agitation?

A. It is of course a totally different agitation and *is and* in the very earliest mention of it they state: "Thus a very thorough contact of oil and pulp is obtained." That is very distinctly superior of course to the possibilities of contact by the slow rotation or slow turning of the Elmore process. It rapidly or thoroughly puts the ore in contact with the oil and with the product of the air bubbles which become coated, forming the froth.

Q. 57. Can you have a demonstration here—that process
2811 on a small scale performed, or perform one this afternoon?

A. I understand that it can be done, and it can be demonstrated. Mr. Dosenbach will demonstrate it.

Q. 58. I have asked Mr. Dosenbach to get the material. Will you describe the demonstration which you propose to have him to do for us following the lines of this article?

A. It simply consists in taking a cylindrical—a tall, cylindrical vessel approximately of the general shape of the percolator shown here and introducing the flowing pulp and the amount of oil corresponding by weight to one of the other of the several percentage figures which are given here in experiments 4, 5 and 6, and then stopping the mouth of the vessel with a cork, giving it a violent agitation and shaking it and almost immediately we have the appearance of the foam referred to by the writers, or an aerated froth. It is instantly recognizable as mineral carrying and in other words as a stable froth produced by air bubbles coated with mineral sulphides, and at the bottom of the vessel are seen the tailings of different color and appearance from the mineralized form.

Q. 59. And to what is the flotation due in this process; what does the buoyancy come from?

A. What?

Q. 60. What is it gives the buoyancy to the float in this process?

A. It is entirely due to the air bubbles which are produced by reason of violent agitation, and which as I say in the presence
2812 of this small amount of oil have a selective action and become mineral coated and give us therefore a mineralized froth, as it is termed, made up of air bubbles with mineral coating and mineral sulphides deposited upon them.

Q. 61. Have you heard some of the testimony here regarding mill operations with quantities of oil running upwards of two per cent and higher?

A. I heard what was testified here.

Q. 62. And will you compare such mill operations with the process described, in that particular?

A. We have the same elements present, of procedure, we have the taking of the thin ore pulp, an amount of oil which is small and approximates one of the illustrations mentioned by these writers, namely, in experiment No. 4, and we have the violent agitation brought about by the rotating blades of the agitator, and if the process was to be intermittent as in a single vessel such as we have here in the percolator, the froth would rise on stopping the agitation in that vessel. In practice it is considered more desirable to carry on the process as a continuous process rather than intermittently and in that case the froth passes over and is caught in the adjacent separating box called the spitzkasten over the edge of which it flows.

Q. 63. Now, referring to the operations which have been described here and carried out in the mills with one per cent and less of oil, will you compare such operations with the process described in this article?

A. With one per cent?

2813 Q. 64. Yes, with any quantity down to the minimum that has been described or the maximum for that matter. Do the remarks you have made apply?

A. There is no difference in principle whatever. The amount of oil can be varied within considerable limits, as far as I have observed, and I see no reason why, from any knowledge of the matter that I have, it should not vary within very considerable limits, and form a froth in which the air bubbles and the oil film coating and the selected mineral sulphides make up the result as the mineralized form?

Q. 65. Now, test No. 1 doctor, if you will just state the substances that are to be used in this experiment I will get Mr. Dosenbach to come in and help you perform it?

A. This is as I understand it to be a demonstration of experiment No. 5 as described in this article in the California Journal of Technology, experiment No. 5, taking one-half quantities. Instead of 100 gramms of ore treated, we start with 50 gms. of ore and we wet—and instead of the 5.3 grams of oil we use 2.17 I believe. The ore is molybdenite sulphide, as is the case in the experiment described in this article.

Q. 66. Which is it you are to repeat, No. 5 or No. 4?

A. I understand example No. 5 is the one we are to carry out.

Q. 67. That is you have an amount of oil equivalent to 5.3?

A. Yes, but we will divide that in two, this being 2.65 grams. The oil taken is fuel oil, California fuel oil, 2.65 grams,

2814 150 cc. of water, that is three times the amount of water and about four-tenths of a cubic centimeter of concentrated sulphuric acid.

Q. 68. Now, Mr. Dosenbach is ready.

Mr. Williams: Is the mesh of the ore given; what is the mesh of this ore?

Mr. Scott: This experiment says 30 mesh. We ought to know it. Do you know, doctor?

A. That is what it says here in my memorandum was used, 30 mesh.

Mr. Williams: And of course you will give us a specimen so that we may put it through a screen analysis. And we arranged at the Wilmington trial the way to make these tests was to fix them up and divide them equally, not to have something given out and said to be something like something that you used.

Mr. Scott: All right, we will let you have a quantity of that. You may divide it into four parts and then you may proceed with what he leaves, to do your experiment.

Mr. Williams: We adopted that in our nine weeks' trial.

Mr. Dosenbach: I prepared for Mr. Williams ahead of time so we can do that.

Mr. Williams: What temperature of water do you expect to use? It seems to be very hot. You didn't tell us.

A. No.

Mr. Williams: What temperature do you propose to use?

2815 A. I don't know what was used at Wilmington, I don't recall.

Mr. Williams: Well, there is nothing in there about hot water at all?

A. No.

Mr. Kremer: Drop your thermometer in and take it.

Mr. Dosenbach: 150 cubic centimeters of water, doctor.

Mr. Williams: At what temperature please?

Mr. Dosenbach: 40 degrees.

Mr. Williams: Forty degrees C.?

Mr. Dosenbach: Centigrade.

Mr. Williams: That is 104° F., is that right, doctor?

A. I can make the calculation. You are going to put the fuel oil in by measure?

Mr. Dosenbach: I am going to drop it out. I have determined how many drops were equal to 2.65 grams. That is the best way to handle this. 75 drops.

(Witness drops 75 drops of oil into the mixture.)

Mr. Williams: I think it should be noted that the amount of oil used is 75 drops?

A. That is down in the record.

Mr. Williams: How much acid?

Mr. Dosenbach: Four-tenths cubic centimeter.

Mr. Scott: Let the record show that it was shook for fourteen seconds.

Mr. Garrison: What kind of acid was used?

Mr. Dosenbach: Concentrated sulphuric acid.

2816 Mr. Scott:

Q. 69. Now, doctor, will you describe the result of this experiment?

A. The results of this experiment, using the amounts which have been put upon the record and which illustrate the fifth experiment on page 37 of the publication are that we have produced a metallized aerated froth in which the air bubbles are the direct cause of the rising of the mineral and there is practically all of the elements in that that we have in the class known as agitated froths. We have the difference in color clearly indicated between the froth layer and the layer of gangue. It is clear now that there is still more in the gangue and retreatment would be probably very desirable and would be ordinarily practiced. We don't have, in other words, a clear tailing as the thing is now; the tailings would have to be retreated, but that of course is current practice as I say, and with such retreatment it looks to me from the indications as almost certain we would have an excellent separation.

Q. 70. You are familiar with the process of flotation as carried on by most of the large companies are you not, the Butte & Superior and the Utah Copper?

A. I have seen it carried on in a large scale in the mills of the two companies, the Butte & Superior Company and the Utah Copper Company of Salt Lake.

Q. 71. Barring the difference between agitation in a tube and bottle and agitation by mechanical agitators, bearing that difference in mind, what essential do you find that this operation, carried out in this experiment, differs from or resembles the large scale operation?

2817 A. It has, as I said before, all of the elements of the process that were carried out in the large scale operations, remembering that in—that this is a so-called intermittent operation that was carried on here, stopping. And when the agitation stops the froth has to rise in the vessel in which the agitation is carried on by shaking. In ordinary practice that is different in appearance because the agitation is going on continuously and the froth is rising at the same time in the side vessel, the so-called separating vessel or spitzkasten and being taken off continuously. That of course cannot be carried on with an intermittent operation as we have here; but the principle of the two is practically the same.

Q. 72. Are you familiar with the bottle test that has been described by the witnesses in the Hyde record which is now a part of this case?

A. I have seen it carried out, and remember the test.

Q. 73. I would like to read the description of that bottle test to you.

Mr. Williams: There is one detail; I don't know what oil was used in that experiment. I did not get a sample of that oil, I think.

Mr. Scott: I think you got one.

Q. 74. He claimed the oil was a fuel oil, wasn't it?

A. I heard it stated here that this was a fuel oil.

Mr. Kremer: I am informed that you were furnished with a sample of that oil; it is called Smelter Fuel Oil.

2818 Q. 75. I would like you to compare this operation under the conditions of the California Journal of Technology article with the description of this operation made by Mr. Chapman, one of the previous witnesses, who testified in the Hyde case, C. R. page 208: "Q. Did you ever make any tests of the operations set forth in the patent in suit by performing those operations in a bottle or test tube?

A. Yes.

Q. 76. Will you describe how you did it?

A. I would take a bottle of the capacity of, say, roughly, 100 cubic centimeters, and in it place 20 grams of ore and 70 grams of water. To this I would add sulphuric acid, equal roughly to 20 pounds of acid to the ton of ore. To this I would add oil by the drop equivalent to one and a half or two pounds of oil to the ton of ore, and agitate vigorously." That is the description of the bottle test which I would like to have you compare with the operation just performed in court.

A. The principle of the two tests is the same—or of the two experiments. If the former be carried out we have here a slightly larger vessel. This is 250 cc. graduated vessel, and the other was described as a bottle containing about 150, but that is an element of no importance in effecting the operation. We have the corresponding conditions of the ore in a thin pulp with the amount of water mentioned and the oil, and some form of agitation as we carried it out.

Q. 77. Now at a later stage of the trial, doctor, when we
2819 have our apparatus ready and set up in the court room here, can you have repeated for us this same operation upon a larger scale?

A. I expect to do so. I had not finished the part of my answer that I started on this morning, in which I have spoken of the foam effect found in the prior record, and following this California Journal of Technology, I was going to go on and refer to Kirby.

Q. 78. You may do that, doctor.

A. Yes. I shall continue that showing the anticipation of the foam claimed in the patent in suit by additional citation of priority, if you will turn to the Kirby patent, No. 809,959.

Q. 79. Very well.

A. In this Kirby patent we have a violent agitation specified, not only in the specifications, but practically in all of the claims, with an apparatus that it can be shown entrains air. That is, I refer to the rotating arms of this apparatus shown in operation in Figure 1, and shown in detail of construction in Figure 4; resulting in the production of an air froth, and as a supplemental step in the Kirby process, there follows the blowing of air or other gas in at the bottom, with a gentle agitation to loosen additional trapped mineral particles, and throw them to the top for air flotation. That feature is again carried out in the patent in suit, where there is a supplemental process involving the introduction of air without the violent agita-

tion, as a supplemental step in bringing more of the mineral to
2820 the surface. In the Kirby process there is produced, as stated in the Kirby patent, a floating scum; a floating hydro-carbon concentrate.

Q. 80. What pages?

A. I find this in lines 79 to 88, page 1 of the patent. I will quote: "Second in allowing the hydro-carbon coated particles to float to the surface of the mass and render the separation substantially complete by gently agitating the mass and by injecting gas into the same, and preferably, also discharge into the mass fine streams of the solution. When the separation is completed, the floating hydro-carbon coated concentrate is removed for subsequent treatment."

There is also described in full detail in Kirby's patent at a subsequent step, the action of a skimming appliance, which skims off the floating concentrate.

Then again we have in the Kirby patent on page 2, line 66, the following as illustrating the second step of the process:

"The air bubbles not only tend to attach themselves directly to the coated particles and then throw them to the surface, but the air becomes dissolved in the water to its maximum capacity. This dissolved air tends to separate itself from the water and attach itself in minute globules to the coated particles."

We have here almost exactly the explanation of the second procedure of the patent in suit, in which, air having been dissolved under pressure in the water, when the pressure is relieved that air escapes and operates in the same way to float the particles to
2821 the surface, and of course forms more or less of an air bubble concentrate—a mineral-covered air bubble concentrate. I consider that in the Kirby patent we have therefore an agitation air froth, followed by the supplemental production of a secondary froth by direct aeration, which is very much the counterpart of the patent in suit; primary agitation and secondary aeration.

Q. 81. Upon page 3 of the Kirby patent, No. 809,959, that is page 745 of the volume as my copy is numbered—line 37, I see the statement: "Rotary movement of the charge leads the floating scum of hydro-carbon liquid air bubbles and concentrates against the curved skimming bar," etc. What significance do you attach to that passage, doctor?

A. We have there the taking off of an aerated froth, which is made up, as stated here, of the hydro-carbon liquid, air bubbles and concentrates. That means air bubbles coated with hydro-carbon liquid, and carrying on their surface a concentrate coating or the mineral sulphide coating, which, together, gives us the mineralized froth from which the concentrate is obtained.

Q. 82. In the patent in suit, No. 835,120, the statement is made that it is by reducing the amount of oil below or to a fraction of 1% that this floating froth is obtained. Do you know of any patent issued to any of the grantees of patent No. 835,120, in which any statement occurs regarding the amounts of oil which can be used for this same purpose?

2822 Mr. Williams: That question is objected to because it contains an assumption that is not founded on fact. Please quote the language of the patent, and do not state something which is not there.

Mr. Scott: My question was fair, I think. If you will point the particular error I will try and correct it.

Mr. Williams: The beginning of it.

The Court: You are stating something which they claim the patent does not contain, so you had better quote that patent.

(Question withdrawn.)

Q. 83. In the patent in suit in the paragraph beginning with line 16, page 1, reference occurs to a certain Cattermole patent, together with the statement that in the process of the Cattermole process—"an amount of oil varying from 4% to 6% of the weight of the metalliferous matter present is agitated with an ore pulp so as to form granules—" In the following paragraph is this statement: "We have found that if the proportions of oily substance be considerably reduced, say to a fraction of one per cent. of the ore, granluation ceases to take place, and after vigorous agitation there is a tendency on the part of the oil-coated metalliferous matter to rise to the surface of the pulp and to form a froth or scum." Now, I will ask you, doctor, whether any of the three grantees of this patent have, in any other patent that you are acquainted with, made any state-
2823 ment in regard to the possibilities of obtaining these froths with the quantities of oil greater than one per cent.?

A. I have found statements bearing on this matter in United States Patent 835,143, issued to Henry Sulman, which patent is found on page 419.

Mr. Williams: That is not the record that the court has.

Q. 84. Page 749 of the printed record?

A. Yes. This patent to which I just referred was applied for a year and a half after the application for the patent in suit, of which the same Henry Sulman was one of the alleged inventors.

Q. 85. How long after did you say, doctor?

A. It was applied for on October 20th, 1906.

Q. 86. The figure is poorly printed. Is that 1906?

Mr. Williams: It was applied for October 20th, 1905. It was issued in 1906.

A. Well, then, it was applied for six months after the patent in suit; I could not read the figure there. That was April 29th and this is May 20th. It was applied for some six months later than the patent in suit, and by one of the patentees of the patent in suit. We find in this patent, 835,143, on page 1, lines 53 to 59, the following:

"The quantity of oil employed is not sufficient to cause the flotation of metalliferous matter by the buoyancy of the oil, but the quantity may be sufficient—say 5% or less on the quantity of the ore—to coat the metalliferous particles with a thin film of oil."

2824 Now, a mixture under these conditions, and with this amount, mixed in a cone mixer—here is that in lines 66 and 67:

"The mixture is agitated in a cone mixer or the like." And it may be heated in this cone mixer or a separate vessel. The element of heat is an important matter in this particular patent. It may be heated in this cone mixer or in a separate vessel, and the result of this treatment was stated, and this amount of oil was stated in lines 73 and 76 as follows:

"A froth or scum rises to the surface, containing practically the whole of the metalliferous matter, while the gangue remains in the pulp. This froth may be skimmed off, or allowed to flow from a spitzkasten."

Again, in lines 76 to 81, showing that it may be skimmed off in the vessel in which it is generated, or taken off in a separate vessel or spitzkasten.

If we turn to the claims of this patent No. 835,143, particularly in the last claim, we have information that is important. The last claim of the patent is as follows:

"The herein described process of concentrating ores which consists in finely powdering the ore, mixing it with water containing less than one per cent. of sulphuric acid, adding a proportion of less than 10% oleic acid, agitating the mixture until the oleic acid has come into sufficient contact with the mineral, heating the mixture up to boiling point, until the metalliferous matter has been raised in a froth to the surface; running the mixture over a current of water
2825 so that the froth is floated away by the current, while the remaining mineral sinks; separating the froth and removing the oleic acid therefrom by a solvent." The bringing of the mixture up to the boiling point, as stated here, is shown to be a vital feature, but we have on page 1, lines 96 to 100, a statement which somewhat qualifies that:

"Or the contents of the agitation vessel may be heated to the necessary extent which approaches the boiling temperature and by cessation of the agitation the mineralized froth rises to the surface."

Q. 87. In the process of this patent 835,143, I wish you would compare what you have just read as to the cessation of agitation and the froth rising to the surface—compare that with the patent in suit with reference to that particular phase of it. Why does the froth rise in the process in the patent in suit?

A. Following agitation; we have that described in the patent in suit, beginning line 31:

"After vigorous agitation there is a tendency on the part of the oil-coated metalliferous matter to rise to the surface of the pulp in the form of a froth or scum."

Q. 88. Then in line 89 of the first page of the patent in suit?

A. We have the thing again stated:

"When agitation is stopped a large proportion of the mineral present rises to the surface in the form of a froth or scum."

Q. 89. Then in patent 835,143 we have the statement which you just read on page 1, line 99?

2826 A. Yes, line 99.

Q. 90. Read that expression again, will you?

A. "And on cessation of agitation, the mineralized froth rises to the surface."

(Recess.)

Q. 91. Before we proceed any further doctor, I did not notice whether the court was shown the appearance of the top of that froth in the test tube, by taking the cork out.

A. I have observed it.

Q. 92. I would like to have the court look at the top of that to see the distinctive appearance.

The Court: What is the distinctive feature?

Mr. Scott: It is to compare it with others which we will show the court later. I do not know that it is a very convenient vessel for the court to see it in.

(The court examined the bottle or test tube containing the ore and froth.)

Q. 93. The froth and tailings are now separated are they not, by comparatively clear water, and the tailings have practically all settled, haven't they?

A. They seem to have settled out almost entirely.

Q. 94. What, if any difference in appearance do you notice between the floating froth and the settled tailings?

A. I believe I stated before that the froth was of such a color as to indicate the presence of mineral sulphides and the presence of mineral sulphides is recognizable also when you look closely
2827 at the froth either from the side or looking down upon it, and of course you recognize the froth structure, the air bubbles; they show very clearly, and the whole effect of the froth here as looked at from above is that of the so-called coated armor plated, aerated froth produced by agitation. On the other hand the tailings—those which first settle—are relatively lighter—notably lighter—and they are rather darker as you get to the top. And looking at the separated layers, it is evident that the tailings would probably have to be reconcentrated to recover from them the values which are now remaining in them.

Q. 95. I think I will ask you next, doctor, to explain to the court the process described in the Everson United States patent.

Mr. Williams: Mr. Scott, how long is that specimen going to be preserved?

Mr. Scott: It depends on the wishes of the court and counsel.

The Court: As far as the court is concerned, there is no occasion to preserve it unless some of you want it preserved for some reason.

Mr. Williams: I was wondering whether it would not be better—I don't want to interrupt the examination, but I was wondering if I had not better make a little cross-examination on that now, since

this is something that is going to be evanescent, here today and gone tomorrow.

Mr. Scott: I have no objections to your interrupting the examination.

The Court: Yes, you may cross-examine.

2828 Cross-examination.

By Mr. Williams:

Q. 96. Does not that float look like a magma?

A. It looks like a magma in some degree. In fact I have repeatedly seen aerated froth resembling a magma. I do not take the name magma as excluding the presence of air.

Q. 97. What do you take it as indicating?

A. A magma is different from an emulsion, in that it is more of an open type of mixture and allows of the sponginess which would be due to the presence of air. You frequently see magmas produced after agitation in very many operations—what are described as magmas, and I have associated it in my mind—the word magma—more with a heavy, dense-looking froth, than I have associated it with the mere emulsion mixture of liquids.

Q. 98. A magma is defined as a paste, isn't it, in the Standard Dictionary?

A. It is described as a thin paste; that is a definition which I heard quoted from a dictionary in the testimony.

Q. 99. Although the California Journal of Technology says these experiments were carried on with a salt solution, you carried them on with a sulphuric acid solution?

A. Either sulphuric acid or salt; the particular ones which are there given with the results, were made with salts.

Q. 100. That is, the experiment that you pretend to repeat
2829 was made with a salt solution and you repeat that with a sulphuric acid solution?

Mr. Scott: I object to the question. There was no pretense that this repeated any individual and particular operation. The quantities were taken from the tabulated statements, and the description was that it might be performed with either a salt solution or an acid solution, and the witness will make it in any kind of solution that counsel wants.

The Court: I think it ought to be made clear on the record. The question is proper enough. The objection will be overruled.

A. The experiment was carried out with sulphuric acid because the general principle of producing the foam effect was clearly stated by the writers to be carried out by them either in an acid solution or in a salt solution. The particular experiments which are there enumerated in the tables were carried out with salt solution, so I did not attempt to make the experiment here to carry out anything more than an illustration of the principle, and I did not state that we

were following literally everything that was stated as to the experiment cited in that summary.

Q. 101. Then this experiment was carried out at 40 degrees Centigrade and 104 degrees F.?

A. 104, yes.

Q. 102. And do you find any statement in the California Journal of Technology of the use of heat?

A. No; that is not referred to.

Q. 103. And isn't it characteristic of the Elmore process,
2830 to which the article refers, that heat was not to be used?

A. Heat is undesirable in the carrying out of the Elmore viscous oil effect, yes.

Q. 104. Because it thins the oil?

A. Yes.

Q. 105. And causes it to drop the mineral?

A. There is no point to it in the understanding of the principle of violent agitation, and I did not find any particular caution with regard to keeping down the temperature to a low temperature at all referred to in this article.

Q. 106. In fact you found nothing in the article which told you to use heat?

A. Bearing on that subject.

Q. 107. And yet you used heat?

A. It was used as a warm solution—slightly warm, yes.

Q. 108. And I presume you used it because you had to use it?

A. I don't think so; I think it can be done at ordinary temperature and I think I have done it at ordinary temperature, and I am ready to try it at ordinary temperature.

Q. 109. You are ready to try it at ordinary temperature and with a salt solution?

A. Yes, sir.

Mr. Williams: I think the experiment is wholly irrelevant
2831 to be in evidence in this case, if your honor please, since it is shown that he has departed in two very important particulars.

The Court: I thought he was repeating the experiment. He has nothing to say about that. I thought it was experiment No. 5; but at the same time it will be allowed in, and it will be a matter of argument. I do not understand that you have made any objection. You can argue it from your standpoint and they can argue it from theirs. You may proceed.

Mr. Williams: Of course it is in evidence only as an interesting experiment.

By Mr. Scott:

Q. 110. Do you find in the California Journal of Technology a reference to the production of foam and froth in an acid solution as well as in the salt solution?

A. Certainly I did.

Q. 111. In your previous testimony in which you stated that the use of heat was objectionable, were you referring to the Elmore lake

effect or were you referring to the process advised by these investigators, using a small amount of oil and violent agitation?

A. I was referring solely to the lake effect, because there the influence of heat has been repeatedly shown to be undesirable, because the most viscous oil is there desirable in the Elmore work, and heat, of course, reduces the viscosity and promotes fluidity of the oil.

Q. 112. And in the foam or froth effect is it your experience that viscosity is necessary?

A. It makes no such difference, and the slight advantage in viscosity of the oil, conducting it at 40° C. or taking it at about
2832 22° C., which would be the ordinary temperature of this room, would not, to my mind, make any difference in the agitation process.

Q. 113. Can you refer to the passage, doctor, in the California Journal of Technology that you just mentioned which has reference to the use of the acid solution as well as the salt solution?

A. The two are put exactly together as alternatives in the resume under the head of "foam effect."

Q. 114. "The foam effect is produced by a violent agitation, especially in acid or salt solution."

Mr. Scott: Before passing to the next subject, I would like to wait a moment and have this experiment repeated in a salt solution; it might save time, doctor, if you are ready—well, they do not seem to be quite ready so I might as well proceed.

Q. 115. You may proceed, doctor, with the discussion of the Everson patent, and when you get to a convenient stopping place you can have this experiment repeated. It appears on page 607 of the Hyde record.

The Court: The patents that you are discussing are all in the Hyde record?

Mr. Scott: Practically all of them. Those which are not I will hand to the court separate copies.

The Witness: Shall I go on?

Q. 116. Doctor, I hate to interrupt you again, but there was another matter with reference to Patent No. 835,143 that you were discussing before recess that I would like to ask you about. In the paragraph beginning at line 15 of Patent 835,143 on the first
2833 page, and the following paragraph beginning on line 30, reference is made to an application, Serial No. 262,889, and upon reference to the patent in suit you will find that that is the number of the application for the patent in suit. In view of that fact I would like to ask you what significance you find in those two paragraphs beginning at lines 15 and 30 of the patent 835,143.

A. We have clearly shown in the paragraph beginning line 15 that in the process described in the specifications of that serial number there stated, 262,889, which I find on examination is the application for the patent in suit, 835,120. We have stated there that a mineral pulp is agitated with a small proportion of an oily substance, such as oleic acid or petrol, or other oils, amounting to a fraction of one per cent, until the oil-coated metalliferous matter forms into the

froth which can be separated by flotation. With that is contrasted the statement beginning on line 30 in Patent 835,143, which is, "It is now found—" The basis of this independent discovery—"It is now found that if the finely powdered ore suspended in water is mixed with a small proportion of oily substance, say 5% or less—the tendency of which is that the "formation of a froth containing the oil-coated metalliferous matter is considerably promoted." Greater separation of the mineral matter from the gangue is secured. The result thus claimed is described: "Substantially all of the metalliferous matter is thus raised in the form of a froth." In line 74, and

"practically the whole of the metalliferous matter is raised
2834 under these circumstances with 5% of oil."

Q. 117. Does the statement that the formation of the froth containing the oily coated metalliferous matter is considerably promoted—does that indicate any relation between the process of 835,143 and that of 835,120 or not?

A. Well, in patent 835,120 we had a tendency stated as the result of certain steps. Here we have a statement that the formation of froth is considerably promoted; so that the language is probably no stronger in one specification than the other.

Q. 118. Do you find in No. 835,143 where the float is referred to as a froth—do you find any attempt to distinguish between the froth formed by the process of patent 835,143 and that formed by the process of patent 835,120, in structure or in efficiency?

A. We have in this patent 835,143, remaining among the claims the statement of the supplementary removing of the oil and the mineral after the separation has been effected. That is no longer found in the patent claims of 835,120, although the file cover indicates, I believe, that it was contemplated?

Q. 119. The removal of the oil?

A. The removal of the oil from the concentrate.

Q. 120. Well, I would like to refer you to the patent in suit, 835,120, page 2, lines 3 to 8?

A. I see it is not eliminated. I see it also in some of the claims of the patent 835,120 and in—in claim 8 for instance.

2835 Q. 121. Just read the part you refer to of claim 8, the patent in suit?

A. There, the supplementary removal of the excess is referred to.

Q. 122. In what words?

A. "Filtering off the froth and removing the oleic acids therefrom by treatment with an alkali." We have instead of this the use of a solvent taking the acid off, in patent 835,143.

Q. 123. Do you find any material difference in describing the removal of oil between the two patents?

A. The alkali would be the more active probably than the solvent, as a practical matter.

Q. 124. Well, now, doctor, may I interrupt you once more to repeat this experiment, which can be done in salt solution at ordinary temperature.

The Court: Mr. Scott, this record you have given me, is that from this court to the Circuit Court of Appeals?

Mr. Scott: The record you have was printed for this court; we printed the record in this court as well as in the Court of Appeals. We narrated it in the court above.

The Court: I suppose these same patents were taken up to the Supreme Court in the record you have indicated to the doctor?

Mr. Scott: Yes.

Mr. Williams: Everything there that has been referred to except the California Journal of Technology was taken up to the Supreme Court of the United States?

2836 Mr. Scott: Possibly it might expedite matters a little if we excuse the doctor and let Mr. Dosenbach testify directly as to what he is doing and the temperature of the solution and so forth.

The Court: Take your own course, whatever seems best to you.

Mr. Scott: I think that will be best. It will simplify the record. Mr. Dosenbach may be recalled for the time being and he can tell us what he is doing.

BEN H. DOSENBACH, recalled in behalf of the defendant, testified as follows:

Direct examination.

By Mr. Scott:

I have here a saturated salt solution. The temperature of this 18°, I take it, Centigrade. After placing the thermometer in the salt solution I find that it is 19° C. I have now placed into the glass graduate 150 cubic centimeters of the salt solution, and I will now add 50 gms. of the molybdenite ore.

Q. 72. You are using the same ore that you used in the experiment with the acid solution?

A. The same ore or a sample of the same ore as I used it with the sulphuric acid solution. I will now drop in a sample of the same oil as previously used in the experiment where sulphuric acid was used, amounting to 75 drops of oil, this being the same oil as was used before, what is known as smelter fuel oil, the amount, 75

2837 drops being equivalent to 2.65 gms. or 5.3 per cent relative to the ore used. I will now agitate for fourteen seconds.

Mr. Garrison: What happens if you leave the cork in? Does it make any difference if you leave the cork in?

A. None at all. After agitating for a period of 14 seconds a froth is formed of greater volume than that which was formed when using sulphuric acid.

Mr. Scott: Do you know any reason for the greater volume of the froth in the salt solution experiment?

A. The reason for that would be due to the salt solution producing more of a foam or froth effect, as will be noticed by reference to the agitation of the salt solution itself, which I am now shaking, and a froth or foam forms on the surface.

Mr. Scott: The witness agitated a bottle containing saturated salt solution and nothing else.

Q. 73. What was the effect of that agitation upon the salt solution?

A. The effect was that a froth was formed on the surface.

Q. 74. And what about the appearance of the water itself, beneath the foam?

A. It is somewhat dense and cloudy, showing the presence of air within the water itself.

Q. 75. Would that same thing take place if you were to shake a dilute solution of sulphuric acid, which was used in the first experiment?

2838 A. That same thing would not take place.

Q. 76. And it is to the properties of the salt itself then that you attribute the greater volume of froth in this second experiment than in the first?

A. I do.

Q. 77. Does the temperature have anything to do with it; the lower temperature in the second experiment as compared with the first?

A. From the results obtained I would say that it doesn't have anything to do with it, the temperature being lower with the salt solution produced a more voluminous froth than that which was produced at 40° when the sulphuric acid solution was used.

Q. 78. Was this a viscous or thin oil that you used? This smelter fuel oil, in this experiment?

A. A viscous oil.

Cross-examination.

By Mr. Williams:

X Q. 79. What kind of salt did you use and what proportion in order to obtain a saturated salt solution?

A. Ordinary sodium chloride, or common salt, I used the proportion as indicated in the California Journal of Technology, which is marked on here, in order to make up the same proportion.

X Q. 80. Just for the record what is it; you say it is marked on the bottle?

A. It is a saturated salt solution having a specific gravity of 1.199 at 15 degrees Centigrade, the specific gravity equals 23° Be.

2839 Redirect examination.

By Mr. Scott:

R. Q. 81. Mr. Dosenbach, you helped Dr. Sadtler in that first experiment, performing the real operation for him, did you not?

A. I did.

R. Q. 82. Now, will you just state the quantities of the different ingredients you used and the time of agitation, and so forth?

A. In the experiment where sulphuric acid was used, which was the first experiment I performed for Dr. Sadtler, I used 150 cc. of water at a temperature of 40° C. I next added 50 gms. of molybdenite ore and next added 75 drops of fuel oil, equivalent to 2.65 gms. or 5.3 per cent relative to the ore used. I next added four-tenths of a

cubic centimeter of sulphuric acid. I then agitated this total mixture for a period of fourteen seconds upon which a mineral froth was formed, being about one and a quarter inch to one and a half inches in thickness.

R. Q. 83. You had previously determined, I presume, that the 75 drops of that particular oil amounted to 2.65 gms.?

A. I had previously weighed out 75 drops from the same beaker.

R. Q. 84. What was your purpose in dropping it out by drops instead of measuring it and pouring it in?

A. The oil being viscous I could not determine just how much I used had I poured it out.

2840 R. Q. 85. You mean it would stick to the measuring vessel and you could not pour out the quantity you measured?

A. It would stick to the measuring vessel or any pipette or burette I may have used.

R. Q. 86. The method by drops you adopted for accuracy?

A. I have.

Recross-examination.

By Mr. Williams:

R. X Q. 87. In regard to the mesh of the molybdenite ore. I do not think we have that there stated?

A. That was crushed through 30 mesh.

R. X Q. 88. Crushed to 30 mesh?

A. Through 30 mesh.

R. X Q. 89. Did you make a screen analysis of it?

A. I have no screen analysis of this particular ore, Mr. Williams, other than I sent it to the laboratory to have it crushed through 30 mesh.

R. X Q. 90. And I do not believe the ore has been described. Can you describe it with any certainty?

A. Well, I can describe the ore as being a molybdenite ore containing about two per cent MoS_2, molybdenum sulphide, and about four or a little more than four per cent of iron, determined as ferrous oxide.

R. X Q. 91. That is ferrous oxide.

A. That is ferrous oxide, and the balance—I can supply you with an analysis of it, if you so desire, but I have it with me, and that is the best of my recollection.

2841 R. X Q. 92. Let us have the analysis later?

A. I will.

Mr. Scott: I would like the record to show that samples of ore and oil used in the last two experiments were furnished to counsel for the plaintiff, and that a sample of the salt solution will be furnished to them if they so desire.

Mr. Williams: It has been furnished.

Mr. Scott: And a sample of the salt solution.

Dr. SADTLER resumed the stand for further

Direct examination.

By Mr. Scott:

Q. 125. Referring again to patent 835,143, and the patent in suit, I would ask your attention to the mechanism described and illustrated for carrying out the processes and ask you to compare these mechanisms?

A. We have in the single page illustration, 835,143, shown exactly the same form of cylindrical mixing vessel with the cone mixer indicated as the form of agitating apparatus. In this patent 835,143 it will be remembered that the statement was made that the froth may be removed from the liquid by skimming or in any usual way or the frothing portion may be separated from the remainder of the pulp by causing this to flow through a spitzkasten, or the like, so that we have the skimming following the usage of the agitator as one described method or the allowing of the contents during agi-
2842 tation to flow into a spitzkasten—into spitzkastens where they come to rest and where the froth raises.

Q. 126. You have referred to the two patents containing illustrations of the same cylindrical mixer?

A. Yes, and the same form of agitating apparatus.

Q. 127. Do you notice any difference at all in the apparatus illustrated in these two patents?

A. What is that?

Q. 128. Can you point out any difference at all between the apparatus illustrated in the two patents?

A. I am not able to see that there is any difference in the illustration of the apparatus.

Q. 129. Now, doctor, if you will proceed and give us a description of the Everson patent, and explain it?

Mr. Williams: Page 607, your honor, of the record which you have, 257 in the Miami record.

A. The selective activity of oil for mineral was known prior to the time of Mrs. Everson, having been indicated in the patent of Haynes, but the patent of Haynes did not present the agitation procedure in any way that could be regarded as satisfactory, and therefore I have not cited the Haynes patent as prior art, strictly speaking. It was acknowledged by Dr. Liebmann, one of the experts for the plaintiff, that Haynes disclosed the selective action of oil, and then followed the next step, the disclosure of the Everson patent and I will begin, because we have in the Everson patent therefore the knowledge already existing of the selective action of oil which is stated here, and she describes what she considers to be the action of the acid
2843 or acid salt solution. On page 1 of the Everson patent we find therefore: "The discovery which forms the basis of my invention is that metals and metallic substances in a comminuted state will unite with compounds of fats or oils and acids, and that such

compounds will not unite with comminuted quartz or other rocky gangue. The essential feature of the method which constitutes my invention, therefore, consists in commingling with pulverized ore a fat or an oil, either animal, mineral or vegetable, or a fatty constituent or acid of an animal or vegetable fat or oil, or any constituent of a mineral oil, together with an acid, either mineral or vegetable or a soluble neutral or acid salt, for the purpose of effecting a union of the free metal or metallic portion of the ore with such admixed mineral, whereby the same may be retained in the subsequent separation of the quartz or other rock therefrom by washing or other suitable means." That is a broad statement of the invention. There is a great deal of statement then with regard to different types of ores which she has tried and which she has operated on, and an enumeration of a number of oils, mineral and animal, and vegetable, which she has also tried, and an enumeration of the acids which she has used, and that feature of her discovery which uses the oil for selective action in the presence of an acid or an acid salt. These are enumerated. And then have upon page 2 of the patent the first example of Everson, which, as I indicated in my classification of processes is an example of a bringing together by the influence of oil, of
2844 metallic particles, and a washing away of gangue, in that respect somewhat like the prior process or patent of Haynes, and is the essential principle involved, in the Cattermole granular agglutination from which the gangue is washed away. But if we direct our attention to the question of priority of invention in the matter of agitation, we turn to the second example of Everson which we find on page 2 of the patent also beginning, line 75: "When petroleum or a constituent thereof is used the oil should desirably be first mixed with the ore, then water added containing a suitable amount of free acid, or a soluble neutral or acid salt, the quantity of water being ample for the washing-out operation, which is to follow, and the quantity of acid sufficient to cut the sand away from the otherwise cohering mass. In the case of petroleum or its constituents paraffine oil, one or two fluid drams of acid to one gallon of water is sufficient for this purpose. The petroleum which I have used was 30° Baume, and I have found three fluid drams of oil abundant for properly moistening two ounces of heavy ore, or in the ratio of about a barrel of oil to the ton of ore, the amount being, of course, variable with the relative bulkiness of the ore." I would desire to say here that the proportion of oil relative—weight—relative to the ore as used by Everson in the second experiment has been variously stated. I think there has been a variety or form of calculation used, probably, and I desire to say in that connection that it is perfectly easy to get an exact figure as to the percentage of oil that was used
2845 by Everson in this second example. The weight relative to the ore being of course, dependent upon the gravity of the oil used. In other words, for a definite gravity of petroleum as mentioned you can figure out absolutely what the per cent of oil is by weight relative to the ore. I have figured that out, taking the data that are here given by Everson, and assuming that the oil was, as stated, 30° Be. The exact amount of oil relative by weight to the

ore is 17 per cent. Under these circumstances—I have then performed—of course it must be remembered that in line 75 we have stated, "Petroleum or constituents thereof," which allows us to use petroleum in the form of a paraffine oil, as stated, or a kerosene fraction, if such are found practicable in handling with a particular ore, either can be used under the terms of this definition of Everson. Now, if we use a kerosene of about 40° Be., which is relatively a heavy kerosene, because kerosene starts with about 40° Be., and many kerosenes are much lower than that—if you start with a kerosene of a 40° Be., the per cent of oil by weight on the ore would be much less than 17.

Q. 130. About how much less?

A. I haven't figured it out on 40°. I meant to do so, but I haven't done it. I will do so and give you the figures exactly. The former calculation I probably better state, so as to make it perfectly clear that the figure is accurately determinable. We have stated there three fluid drams of oil for two ounces. That means ounces avoirdupois, of heavy ore. Now, if we multiply these figures by eight we can work the fluid drams into fluid ounces and we can work the two ounces avoirdupois of the ore
2846 into exactly one pound av. of the ore. Therefore we now have three fluid ounces for every one pound avd. If we multiply by two thousand we would have 6,000 fluid ounces or 46.8 gallons, American gallons, to one ton of ore, a ton of 2,000 pounds. Now comes the weight of the oil of 30° Be., which has a specific gravity at the temperature ordinarily taken of 60° F., of .875. One gallon of liquid of specific gravity .875, would weigh 7.27 pounds av. That is based on the weight of a gallon of water which is unity, of course, in specific gravity. At the same temperature that would give us 7.27 pounds as the weight of a gallon of liquid of this specific gravity. Now we have stated that we have by the calculation 46.8 gallons which would therefore weigh 340 pounds. Therefore we have a weight of oil of 340 pounds, a ton of ore of 2,000 pounds, 17 per cent. And the same can, of course, be stated equally for any other quantity of oil. This is the second example then of Everson.

The Witness: The patent continues:

"In the use of petroleum, or of a liquid constituent thereof, like paraffine oil, the condition of the concentrated mass is more liquid than when a vegetable oil and animal oil or a fatty constituent thereof is used, and a somewhat different means or method should be employed for removing the sand. In practice, the concentrate, after further agitation of the mass and detachment of the sand, will in this case be preferably removed by means of a constant
2847 overflow of water from a washing-out vessel, by which overflow the concentrate will be floated off."

First step, the agitation of the mass. Second step, the detachment of the sand. Then, following that statement:

"The devices and methods now well known in wet separation of ores will be suited to this part of the operation, bearing in mind that the sands and minerals are merely transposed, or their relative posi-

tions are reversed, because the sand is heavier than the mixture of mineral, oil and acid. A proper selection of devices for this purpose will be apparent to those skilled in the wet separation of ores."

That is all we have as to the carrying out of the operation for the removal of the concentrate. The after discussion is as to the treatment of the concentrate.

I would also note that Everson practically makes a third example on page 3 of the patent, line 17.

"It is also not essential to my invention that the acid or salt employed with a vegetable oil be added to the oil before the incorporation of the oil with the ore, as it is entirely practicable, at least in most, and possibly in all cases, to first mix such oil with the ore and thereafter add the acid, as set forth in the use of petroleum."

I said we have a first example, which is of the type of agglutination of the mineral particles and oil, and the washing out of the various minerals from the gangue. We have a second and a third example which contemplate mixing the oil and the ore before
2848 thinning out and as the statement is made here, that it can be done, as set forth in this in the use of petroleum, we may assume that the agitation also is to be considered as a feature of the third example, as well as of the second.

Q. 131. What can you say, doctor, as to this suggestion of Mrs. Everson's that a proper selection of the devices for this purpose will be apparent to those skilled in wet separation of ores," which occurs on line 111, page 2 of the patent?

A. I consider that that refers to the use of the agitating apparatus, and to the use of the flowing off apparatus of the type that is commonly now known as the Spitzkasten type. It was at that time possible to find forms of apparatus for agitation and for the flowing off feature following the agitation, and the saving of the froth.

Q. 132. Do you know any instance of apparatus of that character being known and used prior to August, 1886, the date of this Everson patent?

A. Yes.

Q. 133. Or prior to 1885, the date of the application for it?

A. I have two patents that I will refer to first. The first of these patents is this patent No. 266,219, dated October 17th, 1882. This, of course, is in a different art and is a patent for a piece of apparatus to be used in an entirely different connection, but the only point that is important here is the question as to whether we had aerating and agitating apparatus of a kind suitable to be used for the pur-
2849 pose to which Everson alluded. Here in this patent, which is for a churn, the following statement of its results in lines 57 to 59, referring to the construction of a rotating apparatus—the object of these channels is to aerate the milk and the cream, as the machine is turned." We have here clearly enough an aeration in connection with rapid agitation shown there. In other words, we have a form of apparatus there for aerating in connection with agitation, and that is of course what is to be done if we are to produce an aerated froth.

Mr. Scott: I offer this patent in evidence.

Patent offered in evidence marked Defendant's Exhibit No. 48.

Mr. Williams: It ought to be noted on the record that this patent is given as an example as apparatus for the concentrating of ores, and we find that this device was a churn for churning cream into butter.

The Court: I was just thinking that our mother's egg beaters at the same date would have done the same thing.

The Witness: I did not bring in everything that could be thought of; I merely said it was an aerating and agitating machine.

The Court: It is a form of apparatus that might perform the same purpose, so I will admit it.

Copy of patent 266,219 admitted in evidence, marked Defendant's Exhibit No. 48.

2850 The Witness: The second apparatus is a churn also, but the possibilities are still more clearly indicated. Patent No. 306,441, F. J. Sullivan, October 14th, 1884, and I call attention there to the statement at the bottom of page 1.

"I make the parallel parts of each dasher close together, so that the air is sucked down between them by the rapid rotary motion of the circular part, and thus the entire cream is aerated. This process of distributing air through the cream is assisted by the perforation D^2 by which I have obtained butter in two minutes, and herein is one of the great advantages of my invention."

I call attention also to the fact that the single claim of the patent specifies aeration. He says "and close together, the better to agitate and force air into the cream, substantially as set forth and described, for the purpose set forth."

This still more clearly indicates a type of aerating and agitating apparatus than the other. Those are two citations from an entirely different industry, but bearing on this question of concentration and agitation.

The Court: The quick concentration of milk into butter.

Mr. Scott: I offer this second patent in evidence.

Patent 306,441 admitted in evidence without objection, marked Defendant's Exhibit No. 49.

Whereupon further hearing was adjourned until Tuesday, April 24, 10 a. m.